

**ORTHODONTIC TREATMENT NEED IN CHILDREN AGED 12-14YEARS IN MOMBASA,
KENYA.**

BY
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A mini-thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Dental Sciences in Orthodontics in the Faculty of Dentistry, University of the Western Cape.



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KEY WORDS

- Malocclusion.
- Index of Orthodontic treatment need
- Orthodontic treatment need.
- Demand for orthodontic treatment
- Aesthetics.
- Perception
- Dental Health.
- Mombasa
- Kenya



ABSTRACT

A public orthodontic system generally is designed to prioritize patients so that those who have the greatest need receive treatment. The aim of this study was to compare the subjective perceptions of the occlusal appearance of 11 to 12 year-old schoolchildren of Nairobi with the modified Aesthetic Component (AC) scale of the Index of Orthodontic Treatment Need (IOTN). The objectives were to assess the children's perception of their occlusal appearance, categorise the occlusal appearance using the AC scale, by both the children and researcher; and to compare the children's' perception and the AC of the IOTN.

Satisfaction with appearance of teeth and occlusion as well as peer comparison was investigated. The treatment need and demand was assessed using the modified AC photographs of the IOTN. Altogether, 488 school children (249 girls and 239 boys) assessed their perception of the anterior teeth using a Verbal Descriptor Scale (VDS) and a Visual Analog Scale (VAS) questionnaire. The researcher examined the anterior teeth of the participants and categorised them using the AC of the IOTN. The following results were reported: about two-thirds of the respondents were satisfied with the appearance of their teeth, with the gender difference being statistically significant. About 35% were dissatisfied or very dissatisfied, but reasons for it varied. More than half of the respondents rated their teeth as better than those of their peers and three-quarters were satisfied with their occlusion, the two responses elicited no gender difference.

Treatment need was assessed by use of the AC indicated that there was a moderate agreement between researcher and respondents' in treatment need assessment. The researcher found 36.3% needed treatment against self-perceived need of 30.9%. One-third of the respondents determined by the researcher to 'need treatment', felt 'no need'. There was no statistical

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gender difference in perceived need for treatment. The selection of ranked photographs of the AC by both researcher and respondents demonstrated skewed distributions towards the 'low ranked' or attractive end of the ranking order irrespective of the state of occlusion. Statistical comparison of the two methods used, namely the VDS and VAS, indicated that the responses were significantly different. Therefore it is suggested that any treatment priority assessment should take perceptions of occlusal appearance. into consideration.

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DECLARATION

I, Fiona Githua-Mwang'ombe, hereby declare that the work contained in this thesis is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

SIGNED

.....

F.G. Mwang'ombe

DATE: day of



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DEDICATION

This thesis is dedicated to my husband Elon and children, Myles, Kyle and nephew Ephraim for their understanding and sacrifice.



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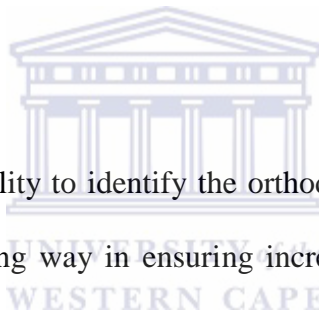
CHAPTER ONE



INTRODUCTION

Moyers revealed that malocclusion may be the result of a combination of minor variations from the normal, range of growth and morphology, where each is too mild to be classed abnormal but their combination summates to produce a clinical problem life (Moyers, 1988).

From the patients' point of view, teeth were second in importance only to background facial appearance (Lew, 1993). Reports have indicated that with increased severity of malocclusion, there is an increasing level of self-recognition (Howitt et al., 1967). Additionally, a confident smile and functional occlusion go a long way in improving a child's quality of life with orthodontics being one of the disciplines with the ability to do so. (Sheilham, 1993).



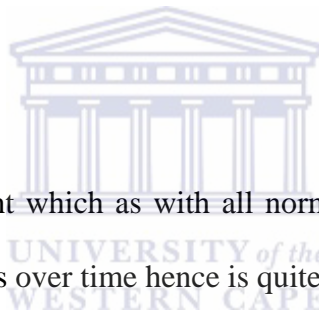
This therefore means that the ability to identify the orthodontic treatment need and demand and conciliate them will go a long way in ensuring increased numbers of confident youth with better “qualities of life”. Correction may result in improved school performance and social acceptance (Jones, 1984; Tobiasen et al., 1987).

These Normative /Oral Health Needs are defined as the quantity of dental services which expert opinions believe ought to be consumed over a relevant period of time in order for its members to become as healthy as is permitted by existing dental knowledge (Jeffers et al., 1971); while demand/ consumer perceived needs are based on their awareness of potential disease and on personal experience and depends on culture, religious educational and social status. These are known to influence the consumers' behavior (Van Wyk PJ, 1994).

The Index of Orthodontic Treatment Need (IOTN), which was developed to rank malocclusion on the basis of the significance of various occlusal traits for dental health and

aesthetic components. The index incorporates a dental health component (DHC) based on the recommendations of the Swedish medical board and an aesthetic component (AC) (Kiyak et al., 1981).

The FDI stated that orthodontic treatment must include an assessment of perception of the aesthetic impairment of a malocclusion (Fédération Dentaire Internationale, 1970). Additionally, Stenvik has shown that professional knowledge about orthodontic perceptions in different age groups is useful (Stenvik et al., 1997). Furthermore it has been reported that the IOTN is reliable, concise and easy to use and interpret while incorporating both the perceived needs, from the aesthetic component and the normative need from the Dental Health Component (Brooke and Shaw, 1989; Cooper, 2000).



The IOTN has a DHC component which as with all normative indices is able to transform along with developmental changes over time hence is quite reliable (Abdullah, 2001).

In addition, the IOTN has been tried and tested with the example of the National Health Service in the United Kingdom routinely using it to identify individuals whose traits of malocclusion are deemed appropriate for the expenditure of resources that is orthodontic treatment (Holmes et al., 1996).

Previous studies carried out in Nairobi, Kenya included the IOTN AC (Psiwa et al., 2004) and the Norwegian Treatment Need Index, which made use of using a structured questionnaire (Ng'ang'a et al., 1997). The results of these indicated that there was a subjective need of 36.3% for the former and 29% for the latter samples examined.

As there is an absence of any previous treatment need studies in Mombasa, Kenya, the study to assess the Orthodontic treatment need using IOTN DHC and AC amongst 12-14 year olds

was carried out to establish baseline data on the children's perception of their orthodontic need and compare this with the normative need.



CHAPTER TWO

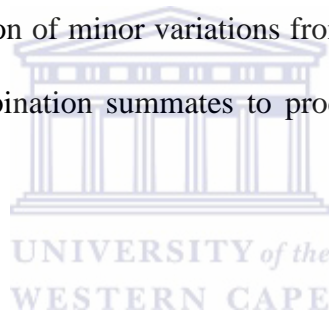
LITERATURE REVIEW



In 1970, the FDI suggested that any meaningful evaluation of need for orthodontic treatment must include the assessment of perception of aesthetic impairment of a malocclusion (Federation Dentaire Internationale, 1970).

Malocclusion

Malocclusion is one of the most common dental problems in mankind, together with dental caries, gingival disease and dental fluorosis (Dhar et al., 2007). It can be defined as an occlusion in which there is a malrelationship between the arches in any of the planes or in which there are anomalies in tooth position beyond the normal limits (Houston et al 2000). It may be the result of a combination of minor variations from the normal, each too mild to be classed abnormal but their combination summates to produce a clinical problem (Moyers, 1988).



Maloccluded teeth can cause psychosocial problems related to impaired dentofacial aesthetics (Kenealy et al., 1989), disturbances of oral function, such as mastication, swallowing, and speech (Proffit and Fields, 2000), greater susceptibility to trauma (Grimm et al., 2004) and periodontal disease (Greiger, 2001). The relevant terminologies of different aspects of malocclusion used in this study are defined below:-

Overjet. Overjet is the distance from the most labial point of the incisal edge of maxillary right central incisor to the most labial surface of the corresponding mandibular incisor measured to the nearest half millimeter, using a metal ruler parallel to the occlusal plane.

Overbite. Overbite is the vertical overlap of incisors, measured to the nearest half millimeter vertically from the incisal edge of the maxillary right central incisor to the incisal edge of the corresponding mandibular right incisor.

Openbite. An openbite was recorded when there was no vertical overlap of the incisors, measured to the nearest half millimeter. A visible space between antagonistic fully erupted canines, premolars, or molars was registered as a lateral open bite.

Lateral crossbite. A lateral crossbite was registered when one or more buccal cusps of the mandibular canines, premolars, and/or molars occluded buccally to the buccal cusps of the maxillary antagonists.

Scissor bite. A scissor bite was registered when any of the maxillary premolars and/or molars totally occluded to the buccal surface of the opposing mandibular teeth.

Midline shift. A midline shift was defined as non-coincident upper and lower midlines when the posterior teeth were in maximum intercuspation.

Crowding. Crowding was recorded when the total sum of slipped contacts measured in the segment was at least 2 mm.

Spacing. Spacing was recorded when the total spacing was at least 2 mm in a segment. (Indian Health Service, 2003).

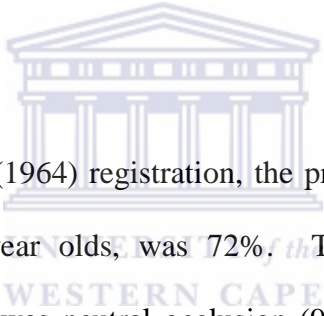
General agreement exists that malocclusion have a multi-factorial aetiology with the basic categories being environmental and genetic.

Therefore, to correct malocclusion, most people will undergo orthodontic treatment to improve their dental appearance. Indeed, their major concerns are usually related to aesthetics (Burden et al., 1995). In relation to facial aesthetics it has been shown that, from the point of

view of the patient, teeth were second in importance only to background facial appearance (Lew, 1993).

2.2 Incidence and Prevalence. (Table 1)

Reported incidences of dental malocclusion vary from 39 to 93% (Thilander et al 2001). Variations in these figures depend on age, ethnic groups, and number of subjects and largely due to differences in registration methods which include: estimates of total frequency of malocclusion, methods based on typological classification and Angles modified classifications (Angle 1907, Thilander et al 2001).



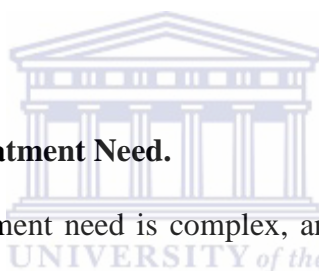
In Kenya, using the Bjork et al. (1964) registration, the prevalence of malocclusion on 919 (468 male, 451 female) 13-15year olds, was 72%. The predominant antero-posterior relationship of the dental arches was neutral occlusion (93%). Specific malocclusion traits were highest for crowding (19%), rotations (19%), posterior crossbite (10%), maxillary overjet (10%), and frontal open bite (8%) (Ng'ang'a et al., 1996).

In Tanzania, using the same registration method as the Kenyan study, the prevalence was 51% (Mugonzibwa et al, 2004a) while a more recent one found it to be 97.6% (Rwakatema et al 2006); whilst using the Angles classification, Kerusuo and co-workers (1991) found 45% prevalence.

In Nigeria, a malocclusion distribution of 76% was found by Onyeaso in 2004.

Table 1 Percentage distribution of malocclusions in different ethnic groups.

Authors	Year	Population	Age	N	Registration	%
Ng'ang'a et al	1996	Kenyan	13-15	919	Björk et al.'1964	72
Kerosuo et al.	1991	Tanzanian	11 – 18	642	Angle classification	45
Mugonzibwa et al.	2004	Tanzanian	3½ – 16	869	Björk et al. 1964.	51
Rwakatema et al.	2006	Tanzanian	12-15	289	Björk et al.'1964	97.6
Onyeaso	2004	Nigerian	12-17	636	Angle's classification	76



Assessment of Orthodontic Treatment Need.

Assessment of Orthodontic treatment need is complex, and is dependent on several factors which include the self, gender, age, family, peers, professional view, socio-cultural, economics, perception, occupation and the strength of the motivation to optimize their attractiveness.

Gosney (1986) has noted that the motivation to undergo orthodontic treatment reflects a number of psychological and social factors. Saltzmann (1967) stated that the demand for orthodontic treatment is primarily by aesthetic value. The need for orthodontic treatment is influenced by the desire to look attractive, self-perception and self-esteem of dental appearance (Elham et al., 2005, Soh et al., 2004).

In addition, awareness of malocclusion and seeking treatment can be explained by an individual's gender where studies have shown females more concerned and critical about their occlusal

appearance and having a higher treatment need and demand than males (Vallitu P et al., 1996; Hassel A et al., 2008; Holmes, 1992).

Furthermore, occlusal traits such as increased overjet and spaced dentition have a negative effect on oral health quality of life among adolescents and their families (Johal et al., 2007; Anasike et al., 2010). In addition to increased overjet, deep bite and crowding can adversely affect body image and self-concept, not only during adolescence, but also into adulthood (Dongieux and Sassouni, 1980).

Parental, peer and self-perception of dental beauty have also been found to influence the need for orthodontic treatment whereby parents may opt for orthodontic treatment to improve dento-facial aesthetics or oral function, or to diminish future psychological problems (Mugonzibwa et al., 2004a)

A similar observation reported by Shaw et al., (1991) was that some referred patients refuse orthodontics for professionally perceived handicapping malocclusions, while others are keen on undergoing treatment for minor deviations. Therefore, some individuals are unaware of marked malocclusions, whilst others complain bitterly about very minor irregularities (Kelly et al., 1973 and Helm et al., 1985). Those aware of their malocclusion traits do not perceive a need for treatment to the same extent as a dentist or an orthodontist (Mandall et al., 1999).

HISTORY AND DESCRIPTION

2.3 Orthodontic indices

Introduction

Many indices have been used successfully to record decay, periodontal disease and temporomandibular joint dysfunction; malocclusion is the only anomaly which varies considerably according to the population. Assessment of Orthodontic needs is difficult, controversial and

varies partly due to the lack of uniformity in diagnosis and partly due to social factors (Moss, 1983). An example is a condition seen as a common aesthetic problem, the maxillary midline diastema, which may occur as a transient malocclusion or may be created by developmental, pathological or iatrogenic factors (Koorra et al., 2007). On the contrary, the same is not regarded as a malocclusion or an aesthetic problem among Nigerians but as a mark of natural beauty (Onyeaso, 2004).

Nevertheless, the need to statistically analyse and compare epidemiological data has resulted in the founding of a number of indices to record traits of malocclusion in numerical and categorical format and to enlist a degree of objectivity into their assessment (Buchanan et al., 1993).

Each occlusal index being devised for a different purpose(s) including;

Diagnostic indices

Epidemiologic indices

Orthodontic treatment need indices

The index for consumer measures

Indices for normative measure of treatment need

Orthodontic treatment outcome indices

Orthodontic treatment complexity indices (Borzabi et al, 2011)

2.3.1 Diagnostic indices

Angle classification system (Angle, 1899)

Incisal categories of Ballard and Wayman (Ballard & Wayman, 1964)

Five-point system of Ackerman and Proffit (Ackerman & Proffit, 1969)

OI- Occlusal Index (Ackerman et al., 1994)

WHO- World Health Organization (World Health Organisation, 1997)

2.3.2 Epidemiologic indices

Index of Tooth Position (Massler & Frankel, 1951).

Mal-alignment Index (Van Kirk & Pennel, 1959).

Occlusal Feature Index (Poulton & Aaronson, 1961).

The Bjork method (Bjork et al., 1964).

Summer's occlusal index (Summers, 1971).

The FDI method (Baume et al., 1973).

Little's irregularity index (Little, 1975).



2.3.3 Orthodontic treatment needs indices

These are either indices for consumer measures or for normative need.

a. Consumer measures include;

Utility values (Fox, 1997)

Dental Aesthetic Index (DAI) (Cons et al., 1986).

Oral Aesthetic Subjective Impact Scores (OASIS), (Mandall et al., 1999).

Index of Orthodontic Treatment Need Aesthetic Component (IOTN AC) (Brook & Shaw, 1989).

Consumer measures are based on their awareness of potential disease and on personal experience. They depend on culture, religious and educational and social status. They are

therefore an important determinant of “demand” as termed by economists which refers to consumer behavior.

Consumer measures might prompt people to use orthodontic service since seekers of orthodontic treatment placed a higher value on aesthetic tooth appearance than non-seekers but do not predict uptake of orthodontic services (Mandall et al., 2005).

The above mentioned indices are all unreliable over time due to developmental changes in the occlusal traits measured (Abdullah, 2001).

b. Indices for Normative measure of treatment need

Angles classification (Angle 1899).

Handicapping Labio-lingual Deviation Index (HLD) (Draker, 1967).

Grainger’s Treatment Priority Index (TPI), (Grainger, 1967).

Salzmann’s Handicapping malocclusion Assessment (Salzmann, 1968).

DAI (Cons et al., 1986)

Summer’s Occlusal Index (OI), (Baume et al., 1973).

Swedish Medical Board Index (SMBI) (Linder-Aronson, 1974).

Index of Complexity, Outcome and Need (ICON) (Daniels &Richmond, 2000)

Index of Orthodontic Treatment Need Dental Health Component (IOTN DHC)
(Brook & Shaw,1989).

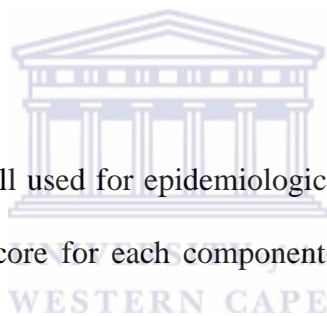
Modified IOTN (Burden et al., 2001).

Normative needs are the oral health needs of a population. These are defined as the quantity of dental services which expert opinions believed ought to be consumed over a relevant

period of time in order for its members to remain or become as “healthy” as is permitted by existing dental knowledge (Jeffers et al 1971, Goodman et al 1990).

Angles classification describes buccal segments separately allowing ease of communication between the dentists and Orthodontists (Angle,1899).

The Epidemiologic survey of malocclusion, like the SOI, records every trait and is thus often used in epidemiological surveys to give the estimates of a prevalence of malocclusion in a given population (Bjork et al., 1964, Baume et al., 1973).



The treatment Need indices are all used for epidemiological surveys and to assess treatment priority. These indices yield a score for each component that is then weighted to give an overall score.

ICON measures the outcome relevant to malocclusion traits and is therefore not totally relevant to consumers’ functional and social treatment requirements (Sheilham et al., 1987).

In Norway, the NOTI is used to determine the level of public health co-payment that the patient may be entitled to, such that there’s total reimbursement for severe malocclusions like cleft lip and palate and little or no re-imburement for minor malocclusions (Espeland et al., 1992).

The Dental Aesthetic Index (DAI) looks into the aesthetic aspects of occlusion. The DAI links clinical and aesthetic components, mathematically, to produce a single score. This score

reflects the malocclusion severity. By using cut-off points, the index was subsequently used to determine the need for orthodontic treatment (Cons et al., 1986).

The Swedish National board or welfare index is also used to give priority to the treatment depending on whether the patient's malocclusion falls within the scope for the Swedish public dental services (Linder et al., 1974). The clinical component of the IOTN is actually a modification of the index used by the Swedish Dental Board (Jenny et al., 1996).

The modified IOTN is a two-grade scale (need/no definite need) based on idea that the IOTN is not an index to measure the complexity; and therefore, there is no benefit in recording the occlusal anomaly that placed the child in treatment need category. The modified IOTN simplifies identifying people in need of treatment and improves the reliability and validity of the index (Burden et al., 2001). By using the modified IOTN, every case with IOTN DHC \geq 4 and/or IOTN AC \geq 8 is classified as being in need of treatment.

2.3.4 Orthodontic treatment outcome indices

Peer Assessment Rating index (PAR) (Richmond et al., 1992)

ICON

2.3.5 Orthodontic treatment complexity indices

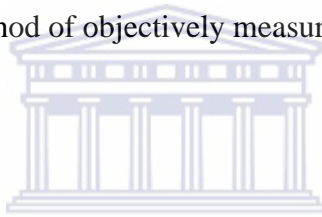
Index of Orthodontic Treatment Complexity (IOTC) (Llewellyn et al., 2007)

ICON

The IOTN, as seen from the classification falls under the consumer measures category (AC) and the normative need measures category (DHC) of orthodontic treatment need indices.

2.4 ASSESSMENT BY USE OF THE IOTN

In 1989, Brook and Shaw described the Index of Orthodontic Treatment Priority, later named the Index of Orthodontic Treatment Need (IOTN) which was subsequently validated by Richmond (1990). It was developed to rank malocclusion on the basis of the significance of various occlusal traits for dental health and aesthetic impairment gaining national and international recognition as a method of objectively measuring treatment need.



In the National Health Service in the United Kingdom many health authorities use this division of IOTN to identify individuals whose traits of malocclusion are deemed appropriate for the expenditure of the resources needed for orthodontic treatment (Holmes et al., 1996).

The IOTN has two discrete components, a clinical component called the Dental Health Component (DHC) based on the recommendation of the Swedish medical board (Linderarson, 1974) and a separate Aesthetic Component (AC) developed by Evans and Shaw (1987).

According to Brook and Shaw, there was no attempt made to combine these into an overall assessment of treatment need. They suggested that the assessment of a patient's treatment

need must include aesthetic impairment and by inference psychosocial need for orthodontic treatment (Brook and Shaw, 1989).

The IOTN was developed to measure treatment need in people or groups to ensure that patients with the greatest needs receive treatment and to aid in orthodontic manpower planning.

Furthermore, the Index of Orthodontic Treatment Need (IOTN), was developed to rank malocclusion on the basis of the significance of various occlusal traits for dental health and aesthetic components. The index incorporates a dental health component (DHC) based on the recommendations of the Swedish medical board (Jenny et al., 1996) and an aesthetic component (AC).



The AC comprises a scale of 10 anterior intra-oral photographs showing different levels of dental attractiveness with grade 1 representing the most attractive and grade 10 the least attractive dentition. The DHC score is based on a grade assigned to the single most severe occlusal trait which makes it an easy and reliable index to use, but ignores the cumulative effect of a number of less severe occlusal deviations (Crowther et al., 1997). As a result, it may under-estimate the severity of a malocclusion in some individuals (O'Brien et al., 1996).

The DHC of the IOTN was developed to try and quantify the impact of a particular malocclusion upon long-term dental health, whereas, the AC attempts to quantify the

aesthetic handicap that a particular arrangement of the teeth poses for a patient (Mandall et al., 2005).

In addition, the AC takes into consideration the public's perception on the orthodontic norms while the DHC entails physical measurements of the occlusal traits associated with the malocclusion.

The IOTN AC is however sensitive to the consumer's perception of their occlusion and to conditions that have the potential of causing psychological and social dysfunction (Brook et al., 1989).

Establishing malocclusion severity using the IOTN (Table 2)

Consistent with other research, the IOTN categories includes the five grades to assess the severity ratings (Proffit et al., 1998).

These range from grade one, "no need" for treatment, to grade five, "very great need." A grade is allocated according to the severity of the worst single trait. The grade of this trait describes the priority for treatment (Jenny et al., 1996).

Table 2: Index of Orthodontic Treatment

	IOTN Score	5	4	3	2	1
	Need for treatment	Very Great	Great	Moderate	Little	None
A	Overjet	>9mm	6-9mm	3.5-6mm incomplete	3.5-6mm competent	
B	Reverse overjet		>3.5mm	1-3.5mm	<1mm	
C	Crossbite		>2mm	1-2mm	<1mm	
D	Tooth displacement		>4mm	2-4mm	1-2mm	<1mm
E	Openbite		>4mm	2-4mm	1-2mm	
F	Overbite		increased, complete & trauma	increased, complete & no trauma	<3.5mm incomplete, no trauma	
G	Pre- or Post- Normal occlusion				½ unit discrepancy	
H	Hypodontia	>1 tooth per quadrant	less severe			
I	Impeded eruption	crowding, displacement, pathology				
L	Posterior, lingual crossbite		No functional occlusion			
M	Reverse overjet *	>3.5mm	1-3.5mm			
P	Cleft lip and palate	Defects				
S	Deciduous teeth	Submerged				
T	Partially erupted		Impacted			
X	Supplemental		supplemental			

* M, Reverse overjet with masticatory or speech difficulty

Assessment

According to the IOTN-DHC, an IOTN score of 1 signifies no treatment need, 2 signifies little need, 3 signifies borderline need, 4 signifies that treatment is required while that of 5 will imply that treatment is greatly required .

Grade 1--None

Other variations in occlusion including displacements less than or equal to 1mm.

Grade 2--Little

Increased overjet greater than 3.5 mm but less than or equal to 6 mm with lips competent at rest.

Reverse overjet greater than 0 mm but less than or equal to 1 mm.

Increased overbite greater than 3.5 mm with no gingival contact.

Anterior or posterior crossbite with less than or equal to 1 mm displacement between retruded contact position and intercuspal position.

Small lateral or anterior open bites greater than 1 mm but less than or equal to 2 mm.

Pre-normal or post-normal occlusions with no other anomalies.

Mild displacement of teeth greater than 1 mm but less than or equal to 2 mm.

Grade 3--Moderate

Increased overjet greater than 3.5 mm but less than or equal to 6 mm with incompetent lips at rest.

Reverse overjet greater than 1 mm but less than or equal to 3.5 mm.

Increased and complete overbite with gingival contact but without indentations or signs of trauma.

Anterior or posterior crossbite with less than or equal to 2 mm but greater than 1 mm displacement between retruded contact position and intercuspal position.

Moderate lateral or anterior open bite greater than 2 mm but less than or equal to 4 mm.

Moderate displacement of teeth greater than 2 mm but less than or equal to 4 mm.

Grade 4--Great

Increased overjet greater than 6 mm but less than or equal to 9 mm.

Reverse overjet greater than 3.5 mm with no reported masticatory or speech difficulties.

Reverse overjet greater than 1 mm but less than or equal to 3.5 mm with reported masticatory or speech difficulties.

Anterior or posterior cross bites with greater than 2 mm displacement between retruded contact position and intercuspal position.

Posterior lingual cross bites with no occlusal contact in one or both buccal segments.

Severe displacement of teeth greater than 4 mm.

Extreme lateral or anterior open bite greater than 4 mm.

Increased and complete overbite causing notable indentations on the palate or labial gingivae.

Patient referred by colleague for collaborative care, e.g., periodontal, restorative, or TMJ considerations.

Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for prosthesis (not more than one tooth missing in any quadrant).

Grade 5--Very great

Defects of cleft lip and/or cleft palate.

Increased overjet greater than 9 mm.

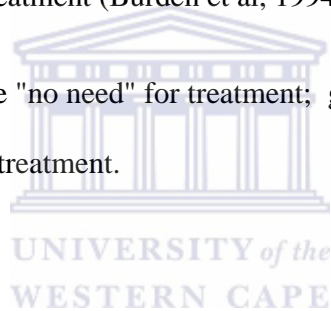
Reverse overjet greater than 3.5 mm with reported masticatory or speech difficulties.

Impeded eruption of teeth (with the exception of third molars) due to crowding, displacement, the presence of supernumerary teeth, retained deciduous teeth, and any other pathologic cause.

Extensive hypodontia with restorative implications (more than one tooth missing in any quadrant) requiring pre-restorative orthodontics.

Suggestions to grade the IOTN-DHC into three instead of the five grades were made and accepted by the IOTN specialist team in Manchester. They are being used as reflecting current British standards for orthodontic treatment (Burden et al, 1994, Richmond et al,1994).

These are; Grades 1 and 2 indicate "no need" for treatment; grade 3, "borderline need"; and grades 4 and 5, "definite need" for treatment.

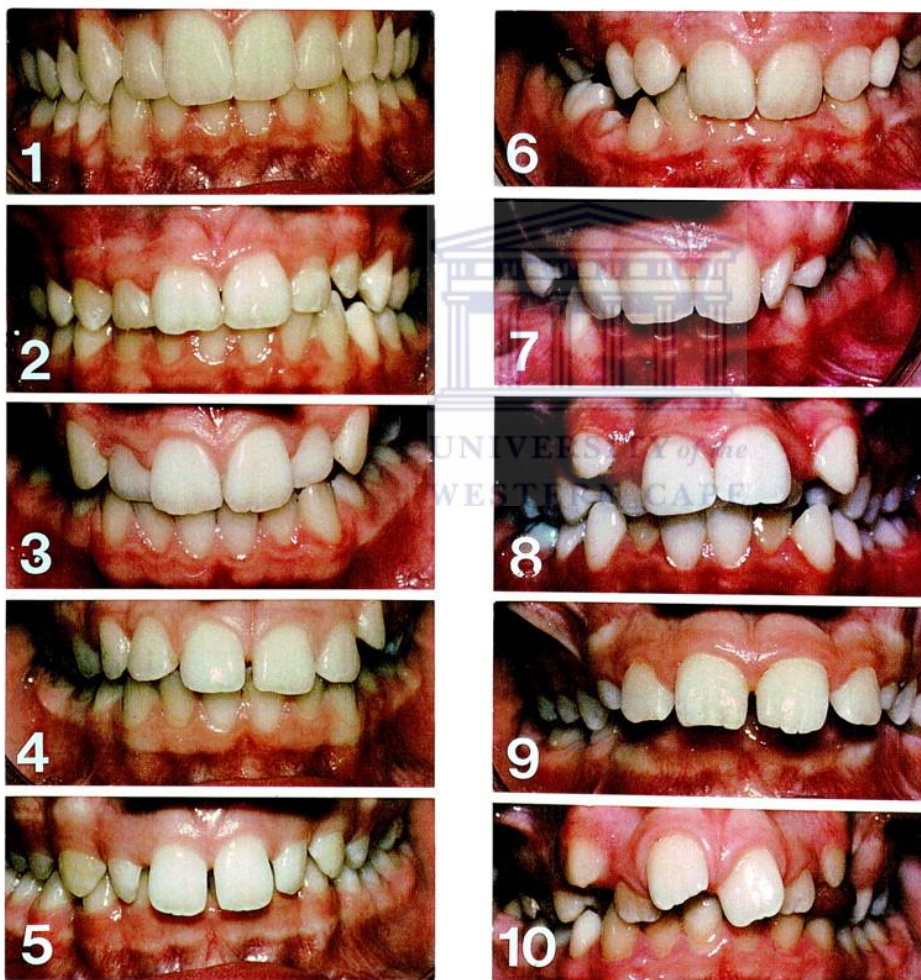


2.4.2 Subjective assessment

Evaluation of the Aesthetic component of the IOTN

The aesthetic component of the IOTN consists of a visual 10-point scale, which represents a wide range of dental attractiveness, illustrated by a series of 10 front view intra oral photographs arranged from number 1, most attractive, to number 10, least attractive as shown in figure 1; with no profile views included.

Figure 1. IOTN PHOTOGRAPHS



These 10 photographs were selected on the basis of the attractiveness ratings of six non dental judges of a sample of 1000 photographs of 12-year-old subjects (Brook and Shaw et al., 1989).

A choice made between 1-4 will signify that the child does not need treatment. A choice between 5-7 means the child may or may not need treatment, thus is a borderline case. A choice of 8-10, implies that the child will definitely need treatment on aesthetic grounds, (Burden et al., 1994, Richmond et al.,1994).

Assessment

The child being rated for orthodontic treatment need is asked: "Here is a scale of 10 photographs of teeth showing different levels of attractiveness. Number 1 is considered most attractive and number 10 the least attractive. Where would you put your teeth on this scale?" The photograph chosen by the child is said to give an indication of the child's treatment need in terms of aesthetic impairment (Brooke and Shaw et al., 1989).



Table 3: Cut-Off Points for AC and DHC

	No or Slight Need	Moderate Need	Definite Need
IOTN AC	1 to 4	5 to 7	8 to 10
IOTN DHC	1 to 2	3	4 to 5

IOTN indicates Index of Orthodontic Treatment Need; AC, Aesthetic Component; DHC, Dental Health Component.

MOTIVATION FOR THE STUDY

The need for orthodontic treatment is well documented in the literature using the IOTN, however, very little information is available regarding the need in Mombasa (Table 4).

The present study was designed to record the level of orthodontic treatment need in a sample of 12-14 year old primary school children in Mombasa, Kenya.



Table 4: Reported studies on Treatment Need

Author Population	No (M:F)	Age	INDEX	No need	Need	Moderate borderline	Definite	Severe Great	V. Severe
Ng'ang'a et al., 1997 Kenya (Nairobi)	919	13-15	Norwegian TNI		29% Objective need				<1%
Ng'ang'a et al., 1997 Kenya (Nairobi)	919	13-15	Norwegian TNI		Subjective 33%				
Mugonzibwa et al., 2004a Tanzania	386 (48:52)	9-18	IOTN – DHC	60%		29%		11%	
Tanzania			AC	30%	14%	34%	18%	4%	
Rwakatema et al., 2007 Tanzania	8136	12-15	DAI	65%		21.5%	6.9%	6.9%	
Drummond, 2003 South Africa	5744	12	DAI	47.7%			21.2%	14.1%	16.8%
Otuyemi et al., 1997 Nigeria	704 (381:323)	12-18	IOTN (DHC)	62		26		12.6%	
Otuyemi et al., 1997 Nigeria	704	12-18	IOTN –AC	66.5		26.6		7%	
Otuyemi et al., 1999 Nigeria	703	12-18	DAI	77.4%		13%		9.2%	
Anasike et al., 2010 Nigeria	805	12-16	DAI	37.6%	21%	17%		24.3%	
Ngonm et al., 2007 Senegal	665	12-13	IOTN (DHC)	23.3%		34.1%		42.6%	
Senegal	665	12-13	AC	69.6%		21.7%		8.7%	
Senegal	665	12-13	ICON	55.9%				44.1%	
Cooper et al., 2000 Manchester (UK)	314	11	IOTN – DHC	0.00%	28%	38%	22%	12%	
Cooper et al., 2000 Manchester (UK)	314	11	IOTN- AC	57.4%		38.4%		8-10%	
Alkhatib et al., 2005 England	2788 48-52%		IOTN – DHC	68%		17%		15%	
Alkhatib et al., 2005 England	2788 48-52%		IOTN-AC	87%		11%	2%		
Burden et al., 1994 England	1829		IOTN-DHC		30.4%		21-24%		
Burden et al., 1994 England	1829		IOTN-AC				0.5-2%		
Brooke and Shaw, 1989 England	333	11	IOTN- AC	58.2%		36.3%		5.4%	

Brooke and Shaw, 1989 England	333		IOTN – DHC	35.1%		32.1%		32.7%	
Holmes, 1992 England	995		IOTN – DHC	7.00%	28.00%	32.00%	28.00%	3.00%	
Holmes, 1992 England	995		IOTN-AC	6%	29%	33%	21%	11.00 %	
Martin et al., 2008 West Virginia (USA)	58 (34:24)	12 -17		17.3%	59.6%				
Elizabeth et., al 2009 USA	1566 (47:53)	8-11	IOTN (DHC)	19.3%		29.90%	33.6%	14.1%	3%
Tausche et al., 2004 Germany	1975 (970:100 5)	11/12	IOTN (DHC)		15 H-gd 3=20%	BORD ONLY 45%	URG + BORD 51.7%		URG 26.2%
Kerosuo et al., 2004 Kuwait	139	14-18	IOTN-DHC		28%				
Al Azemi et al., 2010 Kuwait	1481 753: 728	13-14	IOTN DHC	40.2%			31.1%		
Kuwait	753:728	13-14	AC				23.9%		
Shivakumar et al., 2009 India	1000 (1:1)	12-14	DAI	80.1%			15.7%	3.7%	0.5%
Elham et al., 2004 Jordan	1002	12-14	IOTN DHC&/AC	26%		40%		34%	
Souames et al., 2006 France	511 (268:248)	9-12	DHC	50.1%		28.6%	21.3%		
Souames et al., 2006 France	511 (268:248)	9-12	AC	75%		18%	7%		
Ucuncu et al., 2001 Turkey	250	11-14	IOTN DHC	37.2%		24%		38.8%	
Ucuncu et al., 2001 Turkey	250	11-14	IOTN AC	90.4%		4.8%		4.8%	

2.4.1 Objective Assessment

Previous Research

East Africa

Using the Norwegian Treatment Needs Index, a study done in Nairobi Kenya on 919 subjects aged between 13-15, found that there was 29% objective need for treatment while subjective need was in 33%. Less than 1% had very great need for treatment (Ng'ang'a et al., 1997).

In a Tanzanian study, where 386 subjects between 9 and 18 years were studied using the IOTN DHC and AC, it was found that with the DHC, 30 percent did not need treatment, 29% had slight need for treatment while 22% had definite need for treatment. The AC findings were that 60% had no need/slight need for treatment, 29% had moderate need while 11% had definite need for treatment. (Mungozibwa et al., 2004a).



The differences in the treatment needs between the two neighboring countries are apparent. The differing results, with the different indices in different regions, can be attributed to the inherent objectivity of the assessment system used and their questionable validity and reliability (Downer, 1987).

Using the DHC in Tanzania, Rwakatema and co-workers found that about 65% of the subjects had either no need or had slight need for treatment whereas 35.3% were found with orthodontic treatment needs ranging from elective (21.5%), highly desirable (6.9%) to mandatory (6.9%) (Rwakatema et al., 2007).

South Africa

In South African study, 402 black children from a low socio-economic group aged 12, where malocclusion was recorded as present or absent, revealed that only 11 percent had malocclusion when the DAI was applied. The authors concluded that the low prevalence could be due to well-developed jaws and a tendency to bimaxillary protrusion which was regarded as normal for the population studied. (Hirshowitz et al., 1981).

Comparative studies were done on 14 year olds in the same study area at a 5 year interval to compare the prevalence of malocclusion during their pre-urbanization and post urbanization periods. Using the Occlusal Index of Summers (OIS), the results showed that initially 83% had slight or no need of treatment and 17 percent required urgent treatment. The follow up study revealed that 28 percent required treatment and 12 percent needed fixed appliances. The conclusion was that the increase in prevalence of malocclusion in urban areas as compared to rural areas could be attributed to factors such as degree of westernization, consumption of processed foods, pollution, and ethnic diversity in the urban areas. (De Muelenaere et al., 1987).

In a study conducted on 381 disabled children in Pretoria, South Africa, using the Occlusal Index it was found that 26 percent of those examined needed treatment. This therefore showed that the treatment need amongst the disabled was as great as that for normal children (Ackerman et al., 1994).

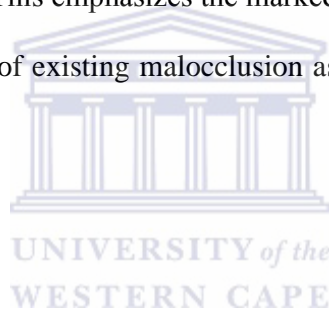
West Africa

In a Nigerian study using the IOTN DHC, it was found that 62% did not need treatment; 26% had moderate need and 12.6% needed treatment. As for the AC, 66.5% did not need treatment, 26.6%, had a moderate need while 7% had definite need for treatment (Otuyemi et al 1997). In a subsequent study on 703 rural and urban based children aged between 12 and 18 years which

attempted to assess whether malocclusion was affected by age, gender and socio-economic backgrounds; it was found that there were no statistically significant differences in their scores between the three variables. Additionally, when using the DAI, 13.4% fell into the elective need category while 9.2% had severe or handicapping malocclusion (Otuyemi et al., 1999).

Another study using DAI in Nigeria showed 24.3% had severe/handicapping malocclusion (Anosike et al., 2010).

In Senegalese study sample constituting 665 12-13 year olds, the DHC and the AC of the IOTN and the ICON classified respectively 42.6%, 8.7%, and 44.1% of the children as having a definite need for orthodontic treatment and 69.6% with the AC and 23.3% with the DHC did not need treatment (Ngomn et al., 2007). This emphasizes the marked differences between a lay person's and the Orthodontist's perception of existing malocclusion as seen from the comparative results of these indices.



Studies done outside Africa

International reports from baseline data published by the WHO for 13-14 year olds in 10 industrialized countries not including the United Kingdom, revealed that orthodontic treatment need ranged 21 percent and 64 percent (WHO, 1985).

An IOTN DHC study in UK showed that all the 314 subjects studied needed treatment whereas the AC reflected that 57.4% were content with the appearance of their teeth, 12 percent had great need and very great need for treatment with the DHC whereas with the IOTN AC only 8-10 percent had definite need for treatment (Cooper et al., 2000).

In a study conducted by Alkhatib and co-workers using the IOTN found that 87% of children assessed had no need for treatment, 11% had borderline need for treatment and 2% had definite need for treatment need. However when using the DHC, they found that 68% did not need treatment, 17% had borderline need and 15% definitely needed treatment, (Alkhatib et al., 2005). Burden et al, revealed a definite need of 21 - 24% and 0.5 - 2% using DHC and AC respectively (Burden et al., 1994). Another study in England showed a definite need with the AC of 58.2% and a DHC score of 32.7% (Brooke and Shaw, 1989). A few years later, Holmes did another study and using the DHC, the definite need was 3% (Holmes, 1992).

In 2008, in the USA, different studies were conducted in various regions. One such study targeting 12-17 year olds where 58 subjects were assessed the results showed that 17.3% did not need treatment and 59.6% required treatment (Martin et al., 2008). The second study was on a larger population of 1566, using the IOTN (DHC) scores, 19.3% did not need treatment, 29.9% needed treatment, 33.6 % had moderate need for treatment, and 14.1% definitely needed treatment while only 3% had very great need for treatment (Elizabeth et al., 2008).

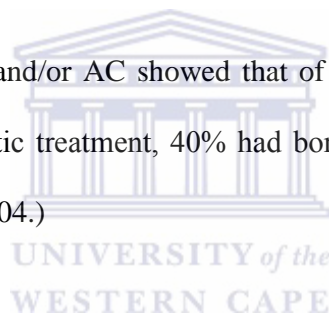
In Germany, Tausche et al (2004) found a 20% need of treatment and a 2% very great need using the IOTN DHC on a population of 1975 children, of whom 970 were males and 1005 were female.

Single traits of malocclusion like the epidemiological registration of malocclusion with the use of photographs showed that IOTN DHC grading at age 11 years is likely to be similar when the patient reaches 19 years whereas the aesthetic component, at age 11 years was less reliable to a clinician since it tends to show an improvement over time. (Bjork et al., 1964; Cooper et al., 2000).

In a Kuwaiti study done in 2004, Kerusso and co-workers found that there was moderate need for treatment which was 28% and in 2010, another study showed that it was 31.1% using the DHC and a 23.9% treatment need with the AC (Al Azemi et al., 2010).

Shivakumar in India (2009) using the DAI found that 80.1% of a population of 1000, 12-14 year olds with a 1:1 sex ratio, did not need treatment while only 0.5% had a handicapping malocclusion.

In Jordan, using the IOTN DHC and/or AC showed that of the 1002, 12-14 year old students, 26% had “no need” for Orthodontic treatment, 40% had borderline need and 34% had definite need for the same (Elham et al., 2004.)



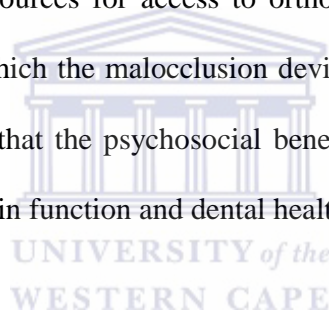
Using the IOTN, a study in France by Souames et al (2006) on 9-12 year olds on a total of 531 school children showed that using the DHC, 50.1% had little or no need, 28.6% had borderline need and 21.3% had definite need for treatment. Using the AC, 75% had little or no need, 18% had a borderline need and 7% had definite need. There was no statistical gender difference in the IOTN AC grade.

11-14 year olds studied in Turkey had a high treatment need using the AC and a comparatively low need using the DHC (Ucuncu et al., 2001).

RELIABILITY OF THE IOTN

The reliability of IOTN over time was investigated by Cooper and others (2000). This was important because there are minor changes in occlusion, during adolescence, that might influence IOTN recordings. It was found that the Aesthetic Component of IOTN tended to show an improvement over time. They recommended that perhaps treatment need categories at age 11 years could be adjusted so that the aesthetic need would also be reliable over time.

In conclusion most of these studies show that there is a significant need for demand for orthodontic treatment and a demand that cannot be ignored. Thilander (2001) and his colleagues study, further supports this, where they showed that there an increasing need over the years in most countries. With scarce resources for access to orthodontic treatment it is important to objectively assess the degree to which the malocclusion deviates from the cultural norms. More so, Cons et al.(1989), has shown that the psychosocial benefits of orthodontic treatment to the patient prevail over improvements in function and dental health.



The myriad benefits of taking orthodontic treatment (such as to prevent tissue damage, to improve the aesthetics and physical function) cannot simply be wished away. Getting to assess the possible accessibility to these benefits by the “common-man” and possibly creating a platform that may in future, bridge this gap and thus improve their “oral health quality of life”, have made this study all the more worthwhile.

CHAPTER THREE



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AIMS AND OBJECTIVES

THE AIM OF THE STUDY:

To assess the need for orthodontic treatment amongst 12-14 year olds in Mombasa, Kenya using the Index of Orthodontic treatment needs(IOTN), Dental Health Component (DHC) and Aesthetic Component (AC).

OBJECTIVES OF THE STUDY

- To evaluate the treatment need using the IOTN AC
- To evaluate the treatment need using the IOTN DHC
- To compare the results of the children's perception against the IOTN

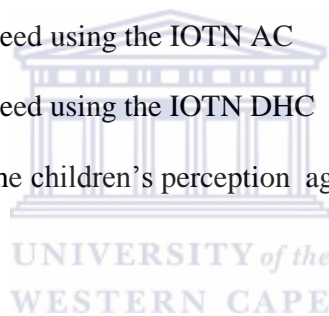
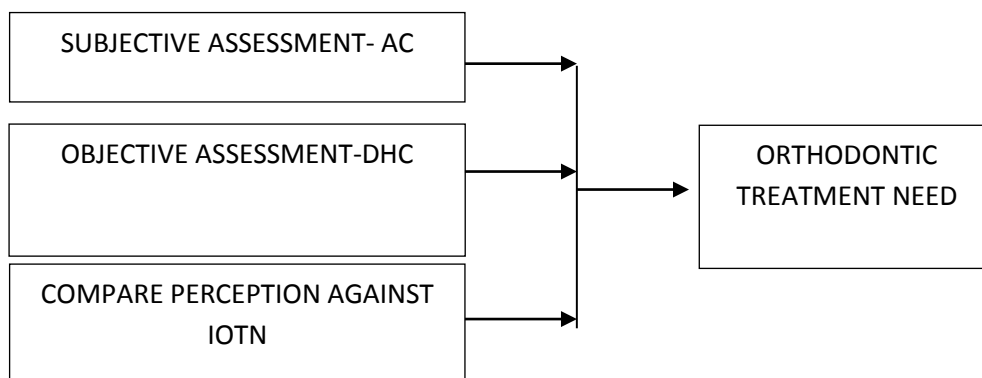


Figure 2: Conceptual Framework





RESEARCH METHODOLOGY

MATERIAL AND METHODS

INTRODUCTION

SAMPLE AREA, POPULATION SAMPLE AND STUDY DESIGN

The project investigated the index of Orthodontic Treatment Need using the DHC and the AC and was conducted in Mombasa County, Kenya. It involved 900 children, aged 12 to 14 years, from primary schools.

SAMPLE SIZE DETERMINATION

The sample size was computed using statomet (bureau for statistical and research methodology). The number of the 12 to 14 year-old school children in public schools of Nairobi was estimated to be 25000 from the register obtained from the Education Department of the Mombasa City Council. P value for sample size determination for this study were based on a study by Ng'ang'a et al., (1997) with the expected frequency of poor perception was 30%, the worst expected was 25%, in which subjective perceptions of the same school children was found to be 33%. Computation of sample size was done as shown below with an inflation clustering. A factor of 30% was factored in since the study was to be carried out in schools by the cluster sampling method, giving an ultimate sample size of nine hundred and thirty seven.

Calculation of sample size:

Margin of error is confidence interval x the standard error.

The standard error is $\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$

$$ME = z\sqrt{\frac{\hat{p}(1-\hat{p})}{n}}$$

where

- ME is the desired margin of error = 0.025
- z is the z-score, e.g. **1.645 for a 90%** confidence interval
- \hat{p} is our prior judgment of the correct value of p.=**30%** (Ng'ang'a et al., 1997)
- n is the sample size (to be found)

$$\text{Thus } (0.025/1.645)^2 = (0.3 \times 0.7)/n$$

$$n = 909$$

$$30\% \text{ of } 909 + 909 = 936.27$$

Thus total sample size is 937.



SUBJECT SELECTION

Schools were selected by simple random sampling procedure and the study subjects selected, from a list of 12-14 year olds by using systematic random sampling procedures in each school.

A list of 94 public primary schools obtained from the County Ministry of Education authorities and a school was randomly selected from each sub county. Each school had at least more than four streams/ grades. A class was then randomly selected in each of the selected schools and the 937 children (51% girls, 49% boys) were randomly selected for inclusion in the study. The targeted children of age 12-14 were mainly in grades 6, 7 and 8.

This population was homogeneous and comprised mainly of the lower to middle socio-economic groups who have minimal access to private dental services.

Inclusion criteria for the respondents included age at the time of the study (12-14 years), African Kenyan origin, history of prior orthodontic treatment and willingness to participate. Age verification was done from the student admission records.

The Educational County of Mombasa, and the school authorities gave permission to conduct the study in the selected schools; the parents and the respondents were given written information and then could decide whether to participate. Only those with no prior orthodontic treatment were included in the study.

MATERIALS

Consent forms

Questionnaires

Dental report forms

Pens

Rulers

Wooden gauged disposable spatulas i.e. with ruler markings to enable better accuracy from the direct measurements and to minimize error during transfer of measurements from the child's mouth to the ruler.

Colour album of IOTN Photographs-randomly spread and not in any specific order (Appendix).

The researcher was the only one that rated the objective needs and compared this with the students' subjective needs (appendix).

EXAMINATION



All 937 children agreed to participate in the study.

A pre-structured questionnaire was administered to the children in their classrooms on the scheduled days. The teacher gave a brief introduction about the investigator to the children. The investigator addressed any concerns or clarifications that the students needed.

The questionnaire was divided into 3 sections. The first section asked for demographic characteristics, particularly age, gender, ethnicity and parents' employment status. The second section dealt with awareness of the children's own occlusions, including questions on their satisfaction with the arrangement and appearance of their teeth, subjective need of treatment, and the

importance of well-aligned teeth. The questions were scaled and scored with 3 or 5 points, as follows:

1. Do you have a nice smile?
 - 1- yes,
 - 2 - no,
 - 3 - do not know
2. a) Are you happy with your teeth?
 - 1- yes,
 - 2 - no,
 - 3 - do not know

b) If your answer to 1 is no;

- What would you change about your teeth?
- a) colour
 - b) size
 - c) arrangement

3. Do you consider well-arranged teeth important for overall facial appearance?
 - i) - Very important
 - ii) - Important,
 - iii) - does not matter,
 - iv) - not important,
 - v) - not important at all.

The third section assessed the respondents' perceptions of malocclusion and comprised questions related to 10 intraoral frontal photographs on which the respondents were asked to match their overall dental appearance on the scale of 10, in order to assess their perception of their dental aesthetics.

These represented the aesthetic component (AC) of the index of orthodontic treatment need (IOTN).

Subsequently, the investigator conducted a clinical examination of the participating children under natural light using the using gauged disposable spatulas and the IOTN DHC (appendix).

DENTAL REPORT

The AC comprises a scale of 10 intra oral photographs, randomly arranged, showing different levels of dental attractiveness, represented as follows;

1-4 = No need for treatment,

5-7 = Borderline need for treatment and

8-10 = Need for treatment' (Richmond et al., 1995).

The DHC comprises five grades which have been recently combined into three categories;

Grades 1 and 2 represent 'No need for treatment';

Grade 3, 'Borderline need for treatment'; and

Grades 4 and 5 represent 'Need.'

Table 5: DHC AND AC REPRESENTATION

	No or Slight Need	Moderate Need	Definite Need
IOTN AC (Richmond et al., 1995)	Photos 1-4	5-7	8-10
IOTN AC – after re-arrangement	Photos 4,7,2,9	3,6,10	1,5,8
IOTN DHC	1 to 2	3	4 to 5

In addition to the IOTN findings, the state of the individual's dental health was written on a piece of paper which was given to the child to take to the parent/guardian stating the need for further consultation.

Before the data collection, the investigator received training and did a mini thesis through a course she undertook at the Government Training Institute, Mombasa.

Variability tests & Calibration

To calibrate the researcher, casts were assessed and an Orthodontist (gold standard) assessed the same casts and any discrepancies found were corrected by having the examiner re-assess till 99% correlation was established.

Agreement analysis using Kappa statistics was done (Freeman, 1987).



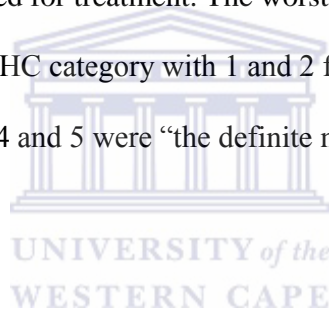
Pilot study

This was done at the Coast General and Likoni district hospitals with fifteen children chosen at random in the month of January, 2014. The aim of doing this was to avoid time and money being wasted on an inadequately designed project. Additionally the feasibility of the questionnaire was tested and a few adjustments were made. It provided a potentially valuable insight and a hence anything missing in the pilot study was added to the full-scale study to improve the chances of a clear outcome. Such changes included adjustments to the questionnaire, organization in distribution of questionnaire and conduction of the intra-oral examination.

Data Analysis

Data was analyzed using the IBM Statistical Package for Social Sciences version 20.0 (SPSS Inc., Chicago, Illinois, USA). Two way frequency tables for IOTN groups by age, gender, ethnicity, occupation of the parents and mode of going to school were compiled. Cross tabulation and chi-square statistics were used to assess bivariate relationships. Multivariate analysis was conducted using Kappa and Analysis of Variance. The *P* value for statistical significance was set at 0.05.

Selection of different photos during the self-assessment exercise, by selection of one photo that closely resembled the child's teeth, signified different categories of needs with photos 4,7,2,9 representing the "no/ slight need" for treatment, photos 3,6,10 represented moderate need while photo 1,5,8 represented definite need for treatment. The worst possible trait selected during intra-oral examination represented the DHC category with 1 and 2 falling into the "No/ Slight need" for treatment, 3 was moderate and 4 and 5 were "the definite need" for treatment group.



CHAPTER FIVE



The results are presented with respect to the following:

1. Description of the socio-demographic characteristics.
2. The frequency distribution and comparisons of responses to the questionnaire.
3. Treatment Need as determined by the Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).
4. Comparisons of the DHC and AC.

Socio Demographic data

There were 937 respondents, from a total of 970 children examined, who met the inclusion criteria for the study. They were drawn from public schools and were mainly of low to middle socio-economic status. The sample consisted of 484 female and 453 male respondents representing 51.0% and 49.0% of the sample respectively (Table 6). The 12 year-olds comprised of 168 (17.9%), 13 year olds 404 (43.1%) and 14 year-olds 365 (39%) of the sample (Table 7). The mean age was 13years and 2 months and the mode was 13 years old. Two Hundred and ninety of them were from the indigenous Mijikenda group (table 8). Regarding their economic standpoints, 67.9% walked to school, 25.3% went via public means while only 6.3% had access to private means of transport. On further probing, this mainly included their parents “border borders”- a native term for motorcycles used for commercial transport. Thirty three percent of the children had no jobs while 14.6% were orphans came from the orphanages (Table 10).

Table 6- Gender

	Frequency	Percent
Male	453	48.3
Female	484	51.7
Total	937	100.0



Table 7: Age

	Frequency	Percent
	168	17.9
13	404	43.1
14	365	39.0
Total	937	100.0

Table 8 – Ethnic Group

	Frequency	Percent
	105	11.2
Arab	60	6.4
Chonyi	10	1.1
Kalenjin	3	0.3
Kamba	76	8.1
Kikuyu	56	6.0
Kisii	18	1.9
Luhya	49	5.2
Luo	143	15.3
Maasai	4	0.4
Meru	12	1.3
Mijikenda	290	30.9
Nandi	2	0.2
Somali	20	2.1
Swahili	44	4.7
Taita	45	4.8
Total	937	100.0

Table 9 –Parental Occupation

	Frequency	Percent
No occupation	312	33.3
Employed in Office	264	28.2
Orphanage	137	14.6
Peasant/ Home jobs	77	8.2
Traders/Business	147	15.7
Total	937	100.0

**Table 10 - Mode of transport**

	Frequency	Percent
On foot	636	67.9
By public means	242	25.8
By private means	59	6.3
Total	937	100.0

FREQUENCY DISTRIBUTION AND COMPARISONS OF RESPONSES TO THE QUESTIONNAIRE

Table 11: Frequency of satisfaction with smile

	Frequency	Percent
Yes	732	78.1
No	109	11.6
Do not know	96	10.2
Total	937	100.0

732 (78.1%) respondents indicated that they have a nice smile, 109(11.6%) did not like their smiles, and 946(10.2%) were unsure about their feelings towards their smiles (Table 11).

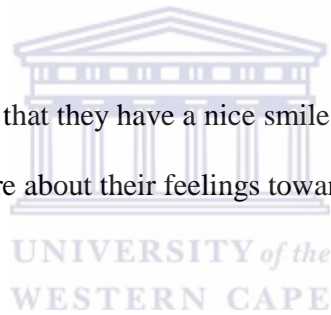


Table 12: Satisfaction with smile according to Age

Do you have a nice smile				
Age	Yes	No	Do not know	
12	129	28	12	169
	17.6%	25.7%	12.8 %	18.0%
13	310	50	44	404
	42.3%	45.9%	46.9 %	43.1%
14	293	31	40	364
	40.0%	28.4%	42.6%	38.9%
Total	732	109	96	937
	100.0%	100.0%	100.0%	100.0%

Chi sq=9.785, df=4, P=0.044

Overall, those who liked their smiles were 17.6% aged 12, 42.3 % aged 13 years and 40.0% were 14 years. Those discontent with their smiles were 25.7%, 45.9% and 28.4% aged 12, 13 and 14 respectively while those who were unsure about their feelings towards their teeth totaled 12.8%, 46.9% and 42.6% respondents aged 12, 13 and 14 respectively. The responses to this question yielded significant differences with $P < 0.05$ (Table 12).

Of the 732 respondents that indicated that they had nice smiles 351 were male and 381 were female. Those that did not like their smiles included 61 (13.5%) of the male and 48 (9.9%) of the female respondents However, statistical analysis by gender yielded no significant difference with

a p-value >0.05 This indicates that there was no gender difference in response to this question (Table 13).

Table 13: Satisfaction with smile by Gender

	Do you have a nice smile		
	Yes	No	Do not know
Male	351	61	41
	77.7%	13.5%	9.0%
Female	381	48	55
	78.9%	9.9%	11.3%
Total	732	109	96
	78.3%	11.7%	10.2%

Pearson Chi-Square 3.841 DF=2 p=0.146

Table 14: Satisfaction with smile by parental occupation

Parents Occupation	Yes	No	Do not know	Total
None	254	31	27	312

	81.4%	9.9%	8.7%	100.0%
Employed in Office	207	27	28	262
	79.0%	10.3%	10.7%	100.0%
Orphan	107	20	10	137
	78.1%	14.6%	7.3%	100.0%
Peasant/ Home jobs	48	16	13	77
	62.3%	20.8%	16.9%	100.0%
Traders/Business	116	15	16	147
	78.9%	10.2%	10.9%	100.0%
Total	732	109	94	937
Total %	78.3%	11.7%	10.1%	100.0%

Pearson Chi-Square 16,318 DF=8 $p < 0.001$

The differences were statistically significant with $p < 0.001$. 81.4% of those with jobless parents liked their smiles, and those who liked their smiles but with parent(s) employed in an office accounted for 79%. The largest group of those who did not like their smiles had parents who were peasants/ had home jobs and these accounted for 20.8% versus 62.3% who liked their smiles in this same category (Table 14).

Table 15 - Satisfaction with teeth

	Frequency	Percent
Yes	206	22.0
No	707	75.5
Do not know	24	2.5
Total	937	100

Only 22.0% (206) of the respondents were happy with their teeth whereas a soaring percentage of 75.5% (707) were unhappy about the appearance of their teeth. (Table 15).

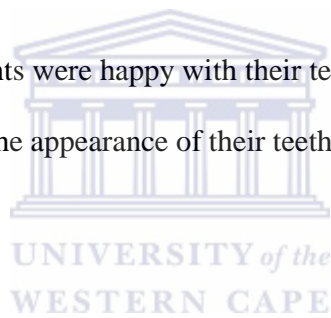


Table 16; Satisfaction with teeth by Age

AGE	Yes	No	Don't Know	Total
12	40	122	7	169
	19.4%	17.3%	29.2%	18.0%
13	80	319	5	404
	38.8%	45.1%	20.8 %	43.1%
14	86	266	12	364
	41.7%	37.6%	50.0%	38.8%
Total	206	707	24	937
	100.0%	100.0%	100.0%	100.0%

P.Chi sq = 9.309, df=4, p=0.05

Of the 707 respondents who indicated that they were unhappy with their teeth, 17.3% were 12 years of age, and 45.1% were 13 years and 37.6% were 14 years. Those who were happy with their teeth were 19.4%, 38.8% and 41.7% aged 12, 13 and 14 years respectively.

The age difference was statistically significant with a p-value of 0.05 (Table 16).

Table 17: Satisfaction with teeth by Gender

	Yes	No	Do not know	Total
Male	85	354	17	456
	18.8%	78.3%	3.7%	100.0%
Female	121	353	7	481
	25.2%	73.4%	1.4%	100.0%
Total	206	707	24	937
	22.1%	75.8%	2.1%	100.0%

Pearson Chi-Square 7.198, df=2 p =0.027

Of the 707 respondents that were unhappy with their teeth, 354(50.1%) were male and 353(49.9%) were female whereas, those that expressed satisfaction with their teeth were 85(9%) male and 121(12.9%) female. The chi-square test was significant with a p-value <0.005. There was a statistical difference in respondents by gender (Table 17).

Table 18: Dissatisfaction with teeth

	Frequency	Percent
Colour	441	62.4
Size	99	14
Arrangement	166	23.5
Total	707	100.0

When the unhappy respondents were asked what they would change about their teeth, 62.4% indicated colour, 14% indicated size, and 23.5% specified the arrangement (Table 18).

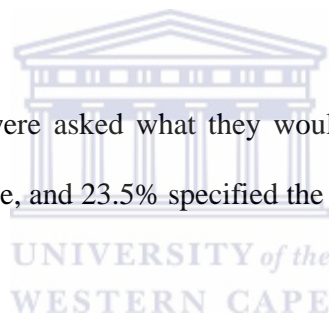


Table 19: Dissatisfaction with teeth by Gender

	Colour	Size	Arrangement
Male	211	57	85
%	29.8%	8%	24.4%
Female	230	42	81
%	32.5%	15.9%	23.1%
Total	441	99	166

%	62.4%	14 %	23.5%
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Pearson Chi-Square 7.198 df=2 p=0.103

The male to female ratio of those who selected arrangement was 24.4%: 23.1% Majority (62.4%) of the respondents were unhappy with the colour of their teeth while 15.9% were unhappy about the size of their teeth. The gender difference was not statistically significant with a p-value of 0.103. (Table 19).

Table 20: Dissatisfaction with teeth according to parental occupation

Parents Occupation	Yes	No	Do not	Total
None	66 (21.2%)	240 (76.9%)	6 (1.9%)	312 (100%)
Employed in Office	65 (24.9%)	190(72.8%)	6 (2.3%)	261(100.0%)
Orphan	362(6.5%)	97(71.3%)	32(.2%)	136(100.0%)
Peasant/ Home jobs	8 (10.4%)	65 (84.4%)	4 (5.2%)	77 (100.0%)
Traders/Business	31 (21.1%)	115 (78.2%)	5(3.3%)	151(100.0%)
Total	206(22.1%)	707 (75.8%)	24 (2.1%)	937(100.0%)

Pearson Chi-Square 13,589 df=8 p<0.001

Amongst those whose parents were unemployed, 76.9%, 71.3% of the orphans, 84.4% of those whose parents were peasants / had home jobs and 78.2% of the traders' children and 72.8% of those whose parents worked in offices were unhappy with their teeth (Table 20).

Table 21: Importance of overall appearance

	Frequency	Percent
Very important	521	55.6
Important	151	16.1
Does not matter	208	22.0
Not important	25	2.7
Not important at all	32	3.4
Total	937	100.0

Overall, majority(55.6%) of the respondents stated that well-arranged teeth were important for overall facial appearance, with 16.1% , 22%,2.7% and 3.4% indicating important, does not matter, not important and not important at all respectively (Table 21).

Table 22: Importance of overall appearance frequency by Age

Age	Very Important	Important	Does not	Not important	Not important
12	93	29	18	5	5
	17.9%	19.2%	16.1%	20.0%	15.6%
13	236	72	43	7	15
	45.3%	47.7%	38.4%	28.0%	46.9%
14	192	50	51	13	12
	36.9%	33.1%	45.5%	37.5%	37.5%
Total	521	151	112	25	25
	100.0%	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square= 7.548 DF=8 P=0.479

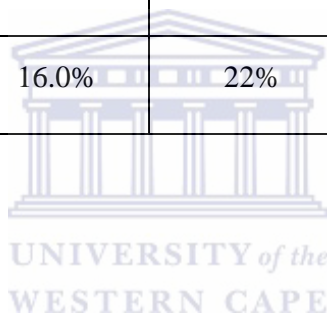
There were 521 participants who considered well-arranged teeth very important for overall facial appearance. The distribution of these respondents according to age was 17.9%, 45.3%, 36.9% aged 12, 13 and 14 years respectively. Five (0.5%) students aged 12 had their response as not important at all, 15 (1.6%) students aged 13 and 12 (1.3 %) students aged 14 had a similar response (Table 22).

Statistical analysis of responses yielded no significant difference with a p-value of 0.479 indicating that there was no age difference in response to this question (Table 22).

Table 23: Importance of overall appearance by gender

Gender	Very	Important	Does not	Not	Not
Male	254	70	100	17	24
	60.9%	16.8%	12.5%	4.1%	5.8%
Female	267	81	108	8	8
	63.0%	19.1%	14.2%	1.9%	1.9%
Total	521	151	208	25	32
	55.6%	16.0%	22%	2.7%	3.4%

Chi Sq. 12.880, DF 4, P = 0.012



The question “Do you consider well-arranged teeth important for overall facial appearance?” elicited 22% of responses from those that were unhappy with the arrangement of their teeth most (61.8%) of whom deemed the association, between the facial appearance and the tooth arrangement, “very important.”

Of those that considered tooth arrangement as an essential for overall facial appearance, 254 were male while 267 were female. On the other hand, 25 (2.7%) respondents considered this relationship not important with male to female ratios, in this category, as 68%:32% respectively, while those that considered it not important at all were 5.8% of the male respondents and 1.9% of the females. 22% of the respondents seemed unperturbed by the tooth to face association.

There were statistical differences in the responses to this question by gender with $p < 0.05$

Table 24: Importance of overall appearance according to parental occupation

Parents	Very	Important	Does not	Not	Not
None	166	47	37	7	5.8%
	60.8%	17.2%	13.6%	2.6%	8
Employed in	153	40	33	8	1.9%
	63.5%	16.6%	13.7%	3.3%	32
Orphan	60	33	18	5	3.4%
	50.8%	28.0%	15.3%	4.2%	
Peasant/ Home	45	14	5	4	
	64.3%	20.0%	7.1%	5.7%	
Traders/Business	97	17	19	1	
	69.8%	12.2%	13.7%	0.7%	
	521	151	112	25	
	62.0%	18.0%	13.3%	3.0%	

Pearson's Chi square 26.077, DF =16, $P < 0.001$

Table 25; Importance of well-arranged teeth for overall facial appearance

	Very	Important	Does not	Not important	Not	TOTAL
Arrangement	97	31	28	12	7	166
	61.8%	19.7%	12.1%	7.2%	4.5%	23.5%

Of the 166 children who were unhappy with the arrangement of their teeth, 61.8% acknowledged that tooth arrangement was very important for overall facial appearance and another 19.7% deemed it important (Table 25).



Fig.3: IOTN - Aesthetic Component (AC)

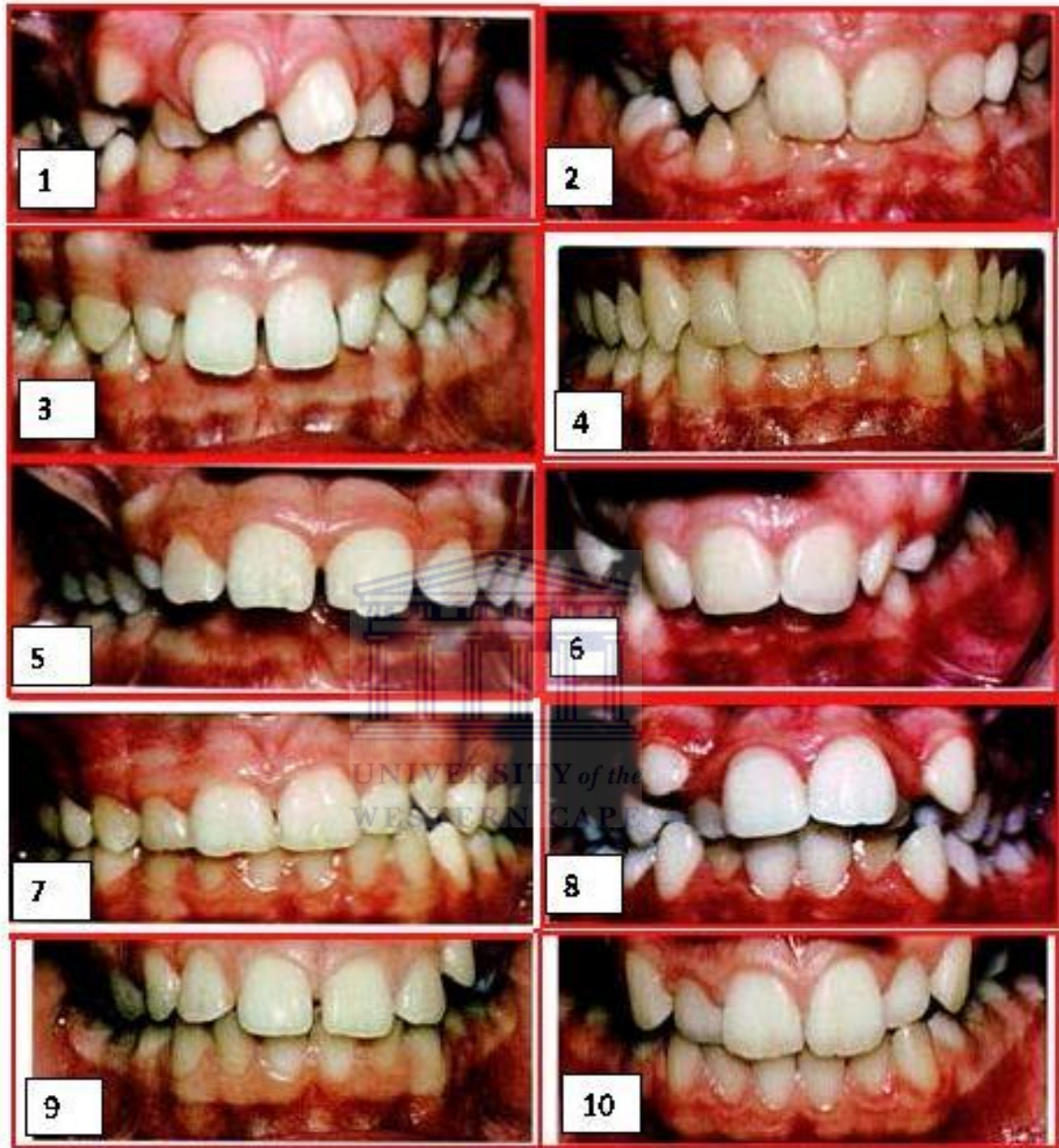


Table 26: Frequency of responses for AC

Rank	Photograph	Frequency	Percent
10	1	2	0.2
3	2	146	15.6
5	3	27	2.9
1	4	371	39.6
9	5	9	1.0
7	6	21	2.2
2	7	222	23.7
8	8	18	1.9
4	9	87	9.3
6	10	26	2.8

Table 26b: Frequency of responses vs. AC: Grouped

	No or Slight Need	Moderate Need	Definite Need
IOTN AC	Photos 4,7,2,9	3,6,10	1,5,8
	826 88.2%	74 7.9%	29 3.1%

Measure of Agreement 0.218, Kappa 0.039

Using the IOTN-AC, 88.2% of the respondents had no / slight need for treatment. 7.9% had moderate need while 3.1% had definite need for treatment (Table 26b).



Table 27: AC by Age

No of photograph resembling teeth	12year olds n (%)	13 year olds n (%)	14 years olds n (%)
1	0 (0%)	1(0.2%)	1(0.3%)
2	17 (10.2%)	76(18.9%)	53(14.7%)
3	4 (2.4%)	10 (2.5%)	13 (3.6%)
4	74(44.3%)	159(39.6%)	138 (38.2%)
5	1(0.6%)	5(1.5%)	3(0.8%)
6	3(1.8%)	7 (1.7%)	11(3.0%)
7	49(29.3%)	93 (23.1%)	80 (22.2%)
8	4 (2.4%)	6 (1.5%)	8 (2.2%)
9	10 (6.0%)	32 (8.0%)	45 (12.5%)
10	5 (3.0%)	12 (3.0%)	9 (2.5%)
Total	167 (100%)	402 (100%)	361 (100%)

Chi Square: 22.343^a DF =20 P-0.322

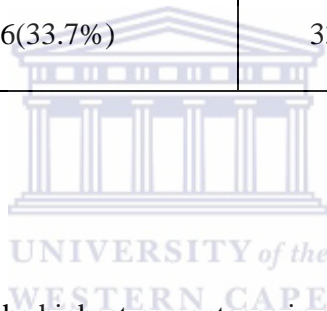
Photograph 4 was the most popular at 39.9% with the greatest percentage being the 12 year olds who were 44.3% of the all 12 year olds, 39.6% of the 13 year olds and 38.2% of the 14 year olds.

Photograph 7 came second with 23.9% of the total respondents. It was selected by 29.3% of 12 year olds, 23.1% of 13 year olds and 22.2% of 14 year olds.

The photographs least selected were photograph numbers 1 at only 0.2% and 5 at 1.0%. These were ranked numbers 10 and 9 respectively (Table 27).

Table 27b : Frequency by Age Grouped

IOTN AC	Photos 4,7,2,9 (No/ Slight need)	3,6,10 (Moderate need)	1,5,8 (Definite need)
12 years	150(16%)	12 (1.2%)	12 (1.2%)
13 years	358(38.2%)	29 (3%)	12 (1.2%)
14 years	316(33.7%)	33(3.5%)	12 (1.2%)



In the subjective need assessment, the highest percentages in each age group fell in the slight/ no need category with the respective results for 12, 13 and 14 year olds being 16%, 38.2% and 33.7% . For the definite need results, all age groups had equal values of 1.2%.

The age difference was not statistically significant with a p-value of 0.322. (Table 27).

Table 28: AC by gender

Rank	No of photograph	Male	Female	Total
10	1	1 (0.2%)	1 (0.2%)	2 (0.2%)

3	2	69 (15.3%)	77 (16.0%)	146 (15.7%)
	3	14 (15.7%)	13 (2.7%)	27 (2.9%)
1	4	163 (36.2%)	208 (43.3%)	371 (39.9%)
9	5	7 (1.6%)	2 (0.4%)	9 (1.0%)
7	6	12 (2.7%)	9 (1.9%)	21(2.3%)
2	7	113(25.1%)	109 (22.7%)	222 (23.9%)
	8	11 (2.4%)	7 (1.5%)	18 (1.9%)
4	9	44 (9.8%)	43 (9.0%)	87 (9.4%)
6	10	15 (3.3%)	11(2.3%)	26 (2.8%)
		450 (100%)	480 (100%)	930 (100%)

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P=0.376

Table 29 : Gender by AC- grouped

IOTN AC	Photos 4,7,2,9 (No/ Slight need)	3,6,10 (Moderate need)	1,5,8 (Definite need)
Male	41.8%	21.2%	2.7%
Female	46.7%	3.5%	3.1%

Pearson's chi square 22.343, df 4, p=0.322

Male to female ratios in the subjective need assessment were 41.8%: 46.7 % for the no need/ slight need category, 21.2%: 3.5 % for the moderate need group and 2.7%:3.1% for the definite need group respectively. The results were not statistically significant with the $P>0.05$, (Table 29).

Table 30: Mode of transport to AC

	Slight need	Moderate	Definite need	Total
On foot	537	54	23	614
	87.5%	8.8%	3.7%	100.0%
I go to and from school	211	14	3	228
	92.5%	6.1%	1.3%	100.0%
By public means	43	4	1	48
	89.6%	8.3%	2.1%	100.0%
By private means	791	72	27	890
Total	88.9%	8.1%	3.0%	100.0%

$P=0.255$

The modes used to go to school and to leave school were co-related to the self-assessment needs and the majority of respondents in each mode had slight need for treatment as follows; 87.5% walk to and from school, 92.15% using public means and 89.6% using private means of transport.

Moderate need for treatment had moderate percentages in each mode while definite need had the least numbers of respondents in each mode. There was no statistical difference found with these results (Table 30).

Table 31: Occupation by AC Cross tabulation

Parents Occupation	Slight need	Moderate	Definite need
None	272	34	0
	88.9%	11.1%	0.0%
Employed in Office	228	17	3
	91.9%	6.9%	1.2%
Orphan	108	0	22
	83.1%	0.0%	16.9%
Peasant/ Home jobs	63	7	2
	87.5%	9.7%	2.8%
Traders/Business	128	14	1
	89.5%	9.8%	0.7%

P<0.001

None of the respondents with unemployed parents had a definite need for treatment whereas 16.9% of the orphans revealed that they definitely required treatment. 2.8%, 1.2%, and 0.7%

represented the respondents who had a definite need for treatment and their parents had home jobs, were employed in offices and were traders/business men respectively. The results were statistically significant with $p < 0.001$ (Table 31).

Table 32: Satisfaction with teeth.

	AC Photographs					
	1	2	3	4	5	6
Yes	0	22	6	94	0	2
	0.0%	15.1%	22.2%	25.6%	0.0%	9.5%
No	2	122	21	267	8	19
	100.0%	83.6%	77.8%	72.8%	88.9%	90.5%
Do not know	0	2	0	6	1	0
	0.0%	1.4%	0.0%	1.6%	11.1%	0.0%
Total	2	146	27	367	9	21
	100.0%	100.0	100.0	100.0%	100.0%	100.0%

	AC Photographs			
	7	8	9	10
Yes	159	14	67	23
	71.6%	77.8%	77.0%	88.5%
No	30	3	10	1
	13.5%	16.7%	11.5%	3.8%
Do not know	33	1	10	2
	14.9%	5.6%	11.5%	7.7%
Total	100.0%	100.0%	100.0%	100.0%

Pearson Chi-Square 30.183^a DF=20 P<0.001 Spearman Correlation 0.061

Those that selected photo 1, 100% were unhappy with the appearance of their teeth. For photo 5 and 8, percentages of those unhappy were 88.9% and 94.4% respectively. None of those in the definite need group were happy with their appearance. 186 (20.1%) of those with slight or no need for treatment were happy, and 618 (66.8%) were unhappy (Table 32).

Table 33: AC vs. Arrangement

	NO NEED	MODERATE NEED	DEFINITE NEED	
IOTN AC Photos	4,7,2,9	3,6,10	1,5,8	
Arrangement	142(86.6%)	105(9.1%)	7(4.3%)	166

Of those dissatisfied with their teeth due to arrangement, 86.6% did not need or had slight need for treatment. This was proportional to 22.9% of those who were generally unhappy with their teeth and 17.3% of the total sample. 9.1% who were unhappy due to the arrangement, had moderate need for treatment on self-assessment whereas the definite need group was composed of 4.3% of them (Table 33).

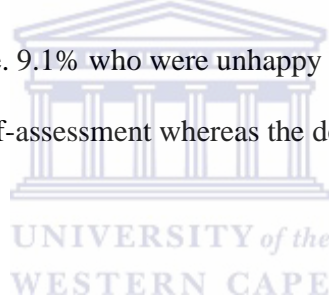


Table 34: Satisfaction with smile

	AC Photographs					
	1	2	3	4	5	6
Yes	2	115	24	302	4	16
	100.0%	79.3%	88.9%	81.4%	50.0%	76.2%
No	0	20	2	35	4	4
	0.0%	13.8%	7.4%	9.4%	50.0%	19.0%
Do not know	0	10	1	34	0	1
	0.0%	6.9%	3.7%	9.2%	0.0%	4.8%
Total	2	145	27	371	8	21
	100.0%	100.0	100.0	100.0%	100.0%	100.0%

P=0.067

	AC Photographs			
	7	8	9	10
Yes	56	0	14	7
	25.2%	0.0%	16.1%	26.9%
No	157	17	72	19
	70.7%	94.4%	82.8%	73.1%
Do not know	9	1	1	0
	4.1%	5.6%	1.1%	0.0%
Total	222	18	87	26
	100%	100.0%	100.0%	100.0%

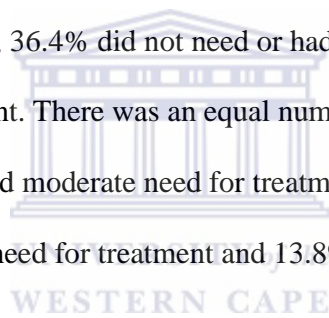
Pearson Chi-Square 35.288 DF=20 P>0.019 Spearman Correlation 0.061

Those that selected photo 1 did not like their smile. 50% of those that selected photo 5, and none of those that selected photo 8 liked their smiles. Respondents that chose photos 4, 7, 2 and 9, 487(52.5%) liked their smiles and 1, 8, 4 (19.8%) were unhappy the responses were statistically significant with P <0.05

Table 34 b: AC by Smile satisfaction

	NO NEED	MODERATE NEED	DEFINITE NEED
IOTN AC Photos	4,7,2,9	3,6,10	1,5,8
YES	342(36.4%)	31 (3.3%)	14(1.5%)
NO	429(45.8%)	31(3.3%)	13(13.8%)

Of those satisfied with their smiles, 36.4% did not need or had slight need for treatment, and 1.5% had definite need for treatment. There was an equal number of those who liked their smiles to those who did not (3.3%) and had moderate need for treatment. Of those dissatisfied with their smiles, 45.8% had no need/ slight need for treatment and 13.8% had a definite need, (Table 34b)



Objective Assessment

Table: 35: Frequency by mode of transport

	DHC		
Mode of Transport	Mild	Moderate	Definite
On foot	594	13	7
	96.7%	2.1%	1.1%
By public means	226	2	0

	99.1%	0.9%	0.0%
By private means	48	0	0
	100.0%	0.0%	0.0%

p=0.227

The modes used to go to school and to leave school were co-related to the normative needs assessment and the majority of respondents in each mode had little/no need for treatment as follows; 96.7 % walk to and from school, 99.1% using public means and 100% using private means of transport. The only group that recorded a definite need for treatment was for those who went on foot (1.1%). There was no statistical difference found with these results. (Table 35).



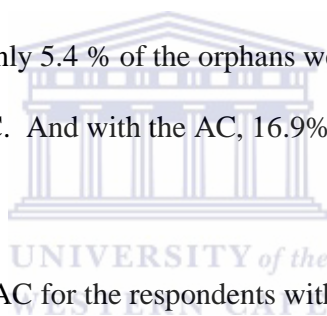
Table: 36. Cross tabulation of DHC to Occupation

Parents Occupation	DHC		
	Mild	Moderate	Definite
None	306	0	0
	100.0%	0.0%	0.0%
Employed in Office	247	1	0
	99.6%	0.4%	0.0%

Orphan	108	15	7
	83.1%	11.5%	5.4%
Peasant/ Home jobs	72	0	0
	100.0%	0.0%	0.0%
Traders/Business	143	0	0
	100.0%	0.0%	0.0%

P>0.001

Of all the respondents examined, only 5.4 % of the orphans were found to have a definite need for treatment according to the DHC. And with the AC, 16.9% of the orphans revealed that they definitely required treatment.



There were similar findings to the AC for the respondents with unemployed parents where none had a definite need for treatment. The results were statistically significant with $p > 0.001$. (Table 36).

Table 37: Cross- tabulation of DHC and question 3c (arrangement)

Arrangement option	No need (1-2)	Moderate 3	Definite 4-5
	159	4	3
	97.0%	1.8%	1.2%

p=0.849

97% of those that were unhappy with the arrangement had slight/ no objective need for treatment, 1.2% had definite need while 1.8% had moderate need for orthodontic treatment. $P > 0.05$ hence there was no statistical difference in the result (Table 37).

Table 38: Correlating AC to DHC

	No or Slight Need	Moderate Need	Definite Need
IOTN AC	Photos 4,7,2,9	3,6,10	1,5,8
	826 88.2%	74 7.9%	29 3.1%
IOTN DHC	1 to 2	3	4 to 5
	882 97.2%	16 1.8%	9 1.0%

Table 39: Comparison of ranked photos and DHC

AC	DHC		
	Mild	Moderate	Definite
Slight need	799	0	0
	85.2%	0.0%	0.0%
Moderate	72	0	0
	7.6%	0.0%	0.0%
Definite need	5	16	7
	0.5%	1.7%	0.7%

Measure of Agreement 0.218, Kappa 0.039



There was an agreement between the DHC and the AC scores. The slight need scored highest for both. Definite need for treatment scored 0.7%.

The agreement in response to ranked photos and DHC was statistically significant with p-value of less than 0.05 (Table 39).

CHAPTER SIX

DISCUSSION



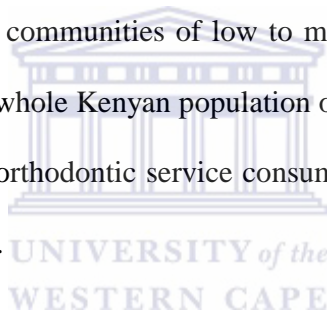
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Introduction

This study was conducted on 12 to 14 year old children attending public primary schools in Mombasa with the hope of raising the level of awareness on the orthodontic treatment need in the second largest city of Kenya (UNEP.org). This will in turn arm the County's Oral health management team with the knowledge that will enable them to set priorities with regards to malocclusion hence effectively plan for orthodontic services in the public facilities.

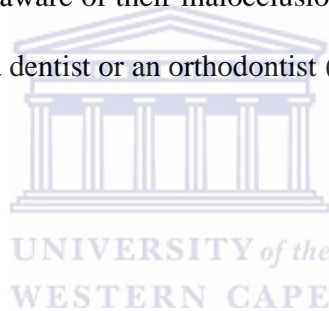
DEMOGRAPHIC FEATURES

The participants were drawn from communities of low to middle socio-economic backgrounds. The sample does not represent the whole Kenyan population of this age group but rather, gives an overview of the potential Kenyan orthodontic service consumers in an urban area. The response rate to the questionnaire was 100%.



A total of 120 children were excluded for various reasons including having received orthodontic treatment while 2 had removable braces. None of these, however, had undergone fixed appliance therapy. Even so, those who had been excluded because of orthodontic treatment were numerically insignificant. The majority of exclusions were due to lack of consent and not fitting within the age bracket for the study. From the 970 that fulfilled the inclusion criteria, a further 33(3.5%) were excluded for having incomplete socio demographic information, hence 937 children were studied with a male to female ratio of 49% to 51% respectively.

Comparisons of this Mombasa sample with other studies were found to vary. In Germany, for example, it was found that using DHC there was no need in 19.30 - 20%, and with the AC there was no need in 45.2% (Tausche et al., 2004; Elizabeth et al., 2009). In England with the DHC, no need was 30.4% (Burden et al., 1994). Variations in the results of the above studies in comparison to those of this study can be attributed to level of awareness, socio-economic background differences (Kelly et al 1973 and Helm et al 1985), and the availability of orthodontic manpower (Shaw, 1981). Other causes of variations in the comparative studies may be due to differences in age, ethnic groups, number of subjects and largely due to differences in registration methods which include: estimates of total frequency of malocclusion, methods based on typological classification and Angles modified classifications (Angle 1907, Thilander et al 2001). Whilst people seem mostly aware of their malocclusion traits, they do not perceive a need or treatment to the same extent as a dentist or an orthodontist (Mandall et al., 1999).



SOCIO-ECONOMIC STATUS

Employment status and mode of transport for attending school were used as an indicator of the socio-economic background but the results suggest that these are unlikely to be comparable across the middle to low socio-economic groups. With regard to the employment status of the children's parents it was found that 33% of the parents had no form of employment and 14.6% of the children resided in orphanages. An additional 8.2% had meager income working as maids, farm helps, housewives who were grouped as peasants/home jobs for ease of analysis. The cross tabulation of the AC with the "mode of transport" as one of the economic indicators failed to yield any significant differences in the self-perceived orthodontic treatment needs. This is consistent with the findings from a Tanzanian study that revealed no social class differences could be detected in the uptake and delivery of orthodontic services (Mugonzibwa et al., 2004a).

This was also similar to the studies done abroad (Shaw et al., 1985, Burden et al., 1994, Eduardo et al, 2006, Prabu et al., 2008). However, there were conflicts with the findings of Kenealy and co-workers (1989) where the middle and higher social class children were found to receive more orthodontic care.

In this study, however, only 5.4% and 16.9% of the orphans were found to have a definite need and with the DHC and AC, respectively. The results were statistically significant with $p > 0.001$.

Demand is influenced by culture, religious and educational and social status. They are therefore an important determinant of “demand” as termed by economists which refers to consumer behavior. Demand may either be effective or potential. It is effective when the consumer is able to satisfy his wants and it is potential where the consumer desires for treatment but is not able to attain it. In this study however, the demand for orthodontic treatment (from AC definite need 3.1%) was comparable with that DHC levels hence was not likely to have been influenced by the ability or lack thereof, to satisfy the consumer desires due to issues raised by Cooper that include; economy, time, ease of access, convenience of access and income (Cooper, 1979).

SMILE SATISFACTION

Children’s self-perceptions of their smiles are part of the psychological aspect of their Oral health related quality of life (OHRQoL) as shown from children as young as 4 years (Elizabeth et al., 2009). In addition, occlusal traits such as increased overjet and spaced dentition have a negative effect on oral health quality of life among adolescents and their families (Johal et al., 2007; Anosike et al., 2010). In this study, 732 (78.1%) respondents indicated that they have a nice smile, whilst 109 (11.6%) did not. The rest were unsure about their smiles probably due to inability to comprehend the question, or 1.0% were being modest (Table 11). Of those satisfied

with their smiles, 36.4% did not need or had slight need for treatment, and 1.5% had definite need for treatment whereas amongst those dissatisfied with their smiles, 45.8% had no need/ slight need for treatment and 13.8% had a definite need, (Table 34b)

No statistically significant differences by gender, to the question on those that liked their smiles, were yielded.

SATISFACTION WITH DENTAL APPEARANCE

The most important motivation for orthodontic treatment is usually an improvement in appearance. (Tullosch et al., 1984; Birkeland et al., 2000). People who are dissatisfied with their facial appearances express more dissatisfaction with their teeth than with any other facial feature (Berscheid et al., 1973).



Only 22.0% (206) of the respondents were happy with their dental appearance (Table 15). 86.6% of those dissatisfied with the arrangement of their teeth, in this study, had no/slight need for treatment. This stark contrast could be attributed to differences in its recognition and evaluation as reflected from the subjective assessment (Albino et al., 1981, Gosney (1986). Using the IOTN-AC , 4.3% of those dissatisfied with the arrangement were found to have a definite need for treatment

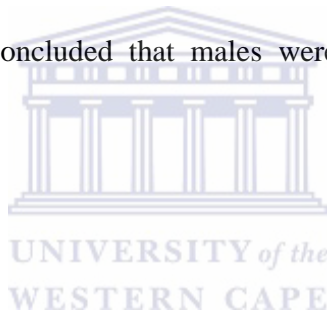
Other studies done by various authors showed that those with low need for orthodontic treatment were happier with their arrangement than those with greater need (Mandall et al. 2000; Shue Te Yel et al. 2000; and Danaei et al. 2010).

In this study, arrangement of teeth was assumed to be representative of dental characteristics of orthodontic concern where the results were found to be 23.5%. The other factors were color and size and these accounted for 62.4% and 14% respectively (Table 18).

SATISFACTION WITH DENTAL APPEARANCE BY GENDER

With regard to responses by gender, out of the 707(75.4%) respondents, only 12% male and 17% female expressed satisfaction with their teeth. However, using the IOTN-AC, assessment of the treatment need by gender did not yield statistically significant results.

Nonetheless, several studies have found females to have a higher treatment need and demand than their male counterparts (Vallitu P et al., 1996; Holmes, 1992). In contrast, however, are findings by Otuyemi et al. (1995) who concluded that males were more likely to seek orthodontic treatment.



DISSATISFACTION WITH DENTAL APPEARANCE

Of the 707(75.4%) respondents that were generally unhappy with their teeth, 17.3% of these were 12 years of age, 45.1% were 13 years and 37.6% were 14 years. This was however not consistent with the fact that 88.8% of these unhappy respondents had slight or need for treatment from the researcher's perspective/ DHC. Tung and Kiyak (1998) attribute this dissatisfaction to the need for peer acceptance during puberty.

SUBJECTIVE NEED ASSESSMENT

Studies have shown that dental photographs can be valid representations of dental attractiveness (Howells et al., 1985) thus intraoral photographs were used to judge the dental attractiveness by the respondents. Additionally, photographs might be more useful than verbal descriptions in

communicating with children keeping in mind that degrees of acceptance of own occlusal disfigurement may be influenced by the sociocultural norms (Espeland et al., 1991)

In this study, the results of the IOTN-AC to age correlation were not statistically significant. Other studies have shown that adolescents are very sensitive on issues concerning the perception of their peers towards them. Inappropriate reaction to dental appearance by their peers may carry negative status in relation to this.. Studies show that malocclusion of the anterior teeth has tremendous social impact in terms of perceived attractiveness, and school functioning (Proffit at al.,2007). This is revealed when children with malocclusion are teased more than those with normal teeth (Kelly et al 1973, Helm et al 1985). All these revelations from the various studies would inevitably lead to a greater subjective treatment need.

Certain malocclusions, generally considered by children as unattractive, such as increased overjet, deep bite and crowding can adversely affect body image and self-concept, not only during adolescence, but also into adulthood.

The study revealed that the photographs perceived as the 'best', irrespective of whether the appearance of their teeth was closer to them or not and despite having randomly pre-arranged the 10 photographs, were the most preferred hence photos 1, 2 and 3 (Brooke and Shaw et al., 1989) represented by photos 4, 7 and 2 respectively scored at 39.6%, 23.7% and 15.6% respectively, (Table 26). Table 26b reveals that using the IOTN-AC, 88.2% of the respondents had no/slight need for treatment whereas 3.1% had a definite need. Differences in recognition and self-evaluation have been documented. (Albino et al., 1981)

This tendency to relate to the best looking photos is supported in the literature. Suggestions floated include; the public's assessment of dental irregularity and perception of psychological and

sociological implications of malocclusion would be better assessed if orthodontic services were readily available (Tullosch et al., 1984).

COMPARISON OF AC TO OTHER STUDIES

The AC results (in this study) categorized according to Burden et al.,(1994) and Richmond et al.,(1994), as no need, moderate need and definite need were found to be 88.9%, 8% and 3.1% respectively. Tanzania, Britain and Turkey have found definite need results similar to that in this study of 4%, 5.4% and 4.8% (Mugonzibwa et al., 2004a ; Brook and Shaw, 1989; Ucuncu et al., 2001)

No need for treatment findings similar to this study were on 12-14 year old schoolchildren with the sample size of 1000. Those who didn't need treatment were found to be 80.1 %.(Shivakumar et al., 2009). In Kenya, 36.3% had a definite need for treatment (Psiwa et al., 2004) whereas using the NOTI, a study by Ng'ang'a et al., (1997) found a subjective need of 29%. Mugonzibwa et al., (2004) used IOTN, AC =38% and found the no need category to equate to 30% while the definite need group was 11% of a sample of 386. , Otoyemi et al., (1997) reported 13% in 12 to 18 year old Nigerian children.

Several studies have been conducted in England using the IOTN-AC. Brooke and Shaw assessed 333 11 year olds and found a definite need of 5.4% (Brooke and Shaw, 1989). A similar sample of 314, 11 year old children revealed a need that ranged from 8 to10 %(Cooper et al., 2000) while yet another study found it to be 11 %(Holmes 1992). A larger sample size was assessed in 2005 and the results were that 2% had definite need for treatment, 11% had moderate need while 87% did not perceive themselves as having need for treatment (Alkhatib et al., 2005).

Variations in analysis while using the same index have been known to exist due to several reasons, namely different sample sizes, ages, urban-rural set up, and socio-economic backgrounds.

CORRELATION OF AC WITH SMILE, APPEARANCE AND ARRANGEMENT

Teeth that appeared the most crowded were the least selected during the assessment of the AC. Contrary to these findings, amongst those that, expressed the greatest dissatisfaction with the appearance of their teeth, 86.6% had no need for treatment on self – assessment, and 9.1% had a moderate need whilst only 4.3% had a definite need. Additionally, in response to the question on whether they were content with their smiles, 52.5% who responded in the affirmative fell in the no need for treatment category. Similarly 88% of those dissatisfied with their arrangement had no/slight need for treatment.



DHC

There was a general agreement between the researcher and the respondents whereby 97.2% and 88.2%, respectively, had little or no need for treatment and similarly definite need encompassed 3.1% from the AC and 1.0% from the DHC categories. In contrast, similar studies done in Nairobi using the IOTN, found a demand of 30.9% (Psiwa et al., 2004) and another, using the NOTI, found a subjective need of 29 and a demand of 33 % (Ng'ang'a et al., 1997). Mugonzibwa et al., (2004) in Tanzania, used the IOTN- DHC and found the no need category to equate to 30% while the definite need group was 11% of a sample of 386.

Variations could be attributed to cultural and educational differences against with the Nairobi population being more urbanized than this Mombasa sample. Other explanations could be that the frequency of malocclusion in the Mombasa population is low similar to the Dar-es-salaam study which is also along the same coastal strip i.e. further south.(Mungozibwa et al,1993). Also,

orthodontic treatment, which can increase with orthodontic awareness, is scarce, (Ng'ang'a,2004.)

CORRELATION OF DHC WITH AC

A relationship between the normative and self-assessment needs was established with the results reading 97.2% and 88.2% respectively. This reveals an almost identical by both the researcher and the children that majority were not in dire need of treatment.

The responses from the moderate need were 7.9% for the AC and 1.8% for the DHC (Table 38). Similarly, the AC responses were higher than the DHC for the definite need category at 3.1% to 1.0%. A study done on different population groups across 9 provinces of South Africa revealed that occlusal malformations are less serious amongst the children belonging to some population groups (Drummond, 2003). Other studies have revealed similar findings (De-Muelenaere et al., 1987). Also, irrespective of the high number, respondents selected by "objective" treatment need indices did not necessarily include all with demand, and vice versa (Tang and So, 1995; Tuominen et al., 1995).

On the contrary, studies by Mandall et al., (1999) found out that people do not perceive a need for treatment to the same extent as a dentist or an orthodontist.

DHC, AC AND GENDER

Age and gender nominal separately correlated with the AC were found not to have any statistical significance. A study conducted by Eduardo Bernabe and Carlos Flores –Mir (Eduardo et al.,

2006) showed that there were no significant differences in the distribution of normative and self-perceived orthodontic treatment need based on sex, age and socio-economic status.

CORRELATION OF DHC WITH SMILE, ARRANGEMENT AND APPEARANCE

An interesting find in this study was that 97% of those dissatisfied with the arrangement of their teeth fell into the no need/ slight need category on objective assessment (Table 37), whereas from the self-assessment, 86.2% of these had little/ no need for treatment. These two findings were contrary to studies that show that the dissatisfaction with the dental appearance is generally related to the severity of the occlusal irregularities, (Burden et al., 1995, Mandall et al., 1999).

Dissatisfaction with one's dental appearance in this study cannot, however, be directly compared with previous studies because the information was elicited differently. This difficulty in eliciting information on dissatisfaction has been expressed by other researchers as well (Shaw, 1981; Burgersdijk et al., 1991). In addition variations as to how individuals express their satisfaction towards their dental appearance have been shown to exist with Kelly and Helm revealing that some individuals are unaware about marked malocclusion while others complain bitterly about very minor irregularities (Kelly et al 1973 and Helm et al 1985).

The Kappa values indicated that there was a moderate agreement in DHC and AC

CHAPTER SEVEN



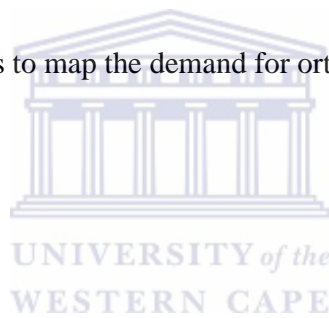
This study showed a contrasting subjective need of 3.1% compared with those done by Psiwa et al (2004) and Ng'ang'a (1997) these results might reflect cultural and educational differences against the more urban set up that is Nairobi. Other explanations could be that the frequency of malocclusion in the Mombasa population is low similar to the Dar-es-salaam study which is also along the same coastal strip, further south (Mungozibwa et al, 1993). Additionally, orthodontic treatment, which can increase orthodontic awareness, is scarce, (Ng'ang'a,2004.)

1. Using the IOTN-AC, less than a fifth (in each question) of the respondents who were dissatisfied with their smiles, appearance and arrangement had no/slight need for treatment.
2. 86.6% of the respondents agreed that well-arranged teeth played a vital role in having an acceptable facial appearance, had no need for treatment on self-assessment.
3. Of those dissatisfied with the arrangement of their teeth, 88% and 97% using the AC and DHC respectively had no/slight need for treatment.
4. There was a moderate agreement between respondents and the researcher with more than four-fifths having no/slight need for need.
5. There were no gender or age differences in objective and subjective treatment need.
6. The economic stand of the respondents did not influence their own perception of treatment need
7. The Aesthetic Component of the IOTN is a valid tool in aesthetic evaluation and assessing the self-perceived need for treatment.
8. The dental health component of the IOTN is just as important in assessing the normative need for treatment.



Recommendations from this study are

1. To extend the use of this valuable index to include subjects with common African features like bimaxillary protrusion, midline diastemas. Incorporation of the persons jaw, or facial assessment when using the index would be vital.
2. To use of the Index of Orthodontic Treatment Need (IOTN) to assess eligibility for treatment similar to the NHS system, whereby treatment is available for grade 4 and grade 5 cases whereas grade 3 cases are judged on an individual basis (Yun et al'; 2006).
3. The need for further studies to map the demand for orthodontic treatment especially in the Kenyan rural settings.



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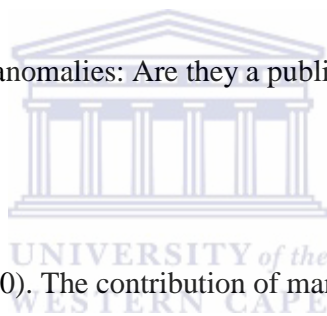
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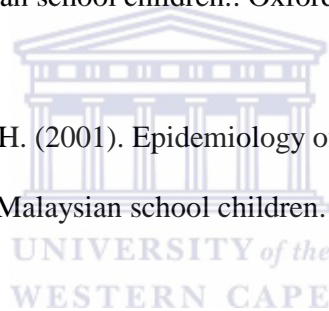
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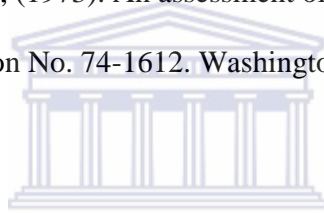
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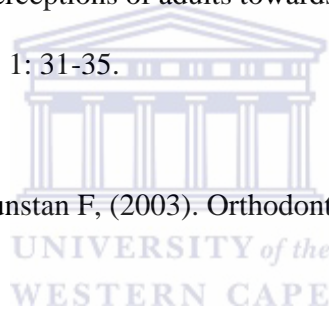
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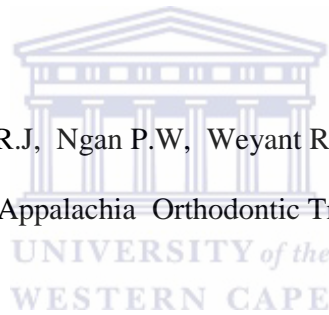
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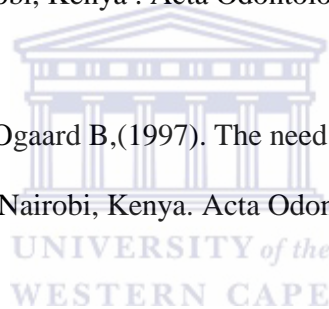
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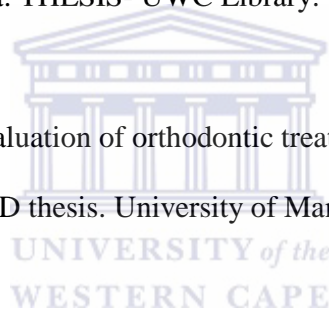
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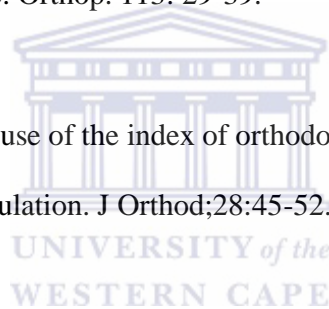
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