PERCEPTION OF OCCLUSAL APPEARANCE IN 11- TO -12 YEAR-OLD SCHOOL CHILDREN IN NAIROBI, KENYA

BY
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KEY WORDS

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Verbal Descriptor Scale (VDS)

Visual Analog Scale (VAS)

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

gender difference in perceived need for treatment. The selection of ranked photographs of the AC by both researcher and respondents demonstrated a 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.

DECLARATION

I, <u>Nathan Kitio Psiwa</u>, 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

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N. K. Psiwa

DATE   day of October of 2004

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DEDICATION

This thesis is dedicated to my brother in-law, Michael Selembu and his wife Linah Naeku, for their support and motivation; my wife Jane and children, Siya and Wendy for their understanding and sacrifice.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER ONE:
INTRODUCTION

It was recognized over three decades ago that any meaningful evaluation of the need for orthodontic treatment must include an assessment of perception of the aesthetic impairment of a malocclusion (Fédération Dentaire Internationale, 1970). Others have also concluded that reliable measures of dental aesthetics are essential if the social and psychological implications of malocclusion are to be assessed (Howells and Shaw, 1985). Further, indirect support for the use of measures of Aesthetic Impairment has come from longitudinal studies of the relationship between malocclusion and dental disease (Helm and Peterson, 1989; Shaw et al., 1991). These investigations confirmed that, the main ill-effects of malocclusion were psychosocial in nature and related to the aesthetic impairment, rather than any functional disadvantage (Hunt et al., 2002).

Studies on prevalence of malocclusion and need for orthodontic treatment in Kenya have been published (Ng'ang'a et al., 1996 and 1997). They recorded a frequency of malocclusion of 72%, treatment need of 29% using the Norwegian Treatment Need Index (NTNI) and subjective need of 33% with a structured questionnaire. The reported incidences make it clear that the majority of children have irregular teeth and an occlusal relationship that differs from the ideal. No studies have addressed the psychosocial nature of orthodontic treatment demand and its related aesthetic impairment. Information on societal perception of occlusal appearance is important for the planning of orthodontic treatment need and an organised service as well as in assessing the resources required for such (Foster and Menezes, 1976).

The demand for orthodontic treatment is increasing in most countries (Thilander et al., 2001). Therefore, rational planning of orthodontic measures on a population basis is essential in assessing the resources required for such a service. This stresses the importance of studies that investigate factors that influence demand for orthodontic treatment.

It is in view of the above deficiencies that it was considered important to assess the perception of occlusal appearance in 11 to 12 year-old Nairobi school-children and to evaluate and compare the Index of Orthodontic Treatment Need (IOTN) Aesthetic Component (AC) grade to the children's subjective perception of their own occlusal appearance.

CHAPTER TWO:
LITERATURE REVIEW

INTRODUCTION

The face is seen as the most important physical characteristic in the development of the self-image and self-esteem (Berscheid et al., 1973; Hershon and Giddon, 1980). People who are dissatisfied with their facial appearances, however, often express more dissatisfaction with their teeth than with any other facial feature (Berscheid et al., 1973). Judgments involved in the perception of malocclusion are complex and are generally considered to be highly subjective (Stricker, 1970; Hershon and Giddon, 1980; Phillips et al., 1992). Therefore, it is not surprising that most people view orthodontic treatment primarily as a way to improve dentofacial appearance (Burden and Pine, 1995).

The psychological, social, and cultural aspects of malocclusion are an integral part of health care. While malocclusions are routinely documented, the psychosocial disability is not readily determined and the impact of malocclusion cannot be measured objectively. When resources are limited for orthodontic services, it becomes particularly important to assess objectively the degree to which a person's occlusal appearance deviates from the cultural norms.

Since the orthodontic patient population today is composed of people with a heterogeneous mixture of genetic backgrounds, it is important that treatment goals should be finding a common ground on which we can meet to embrace reasonable objectives and common standards of interpretation of aesthetic harmony.

Only a few studies have addressed the perception of malocclusion in the African cultural context (Otuyemi et al., 1998; Dawjee et al., 2002; Mugonzibwa et al., 2004), but in the case of Kenya, none has been conducted to date. Thus there is a rational and empirical basis for determining the perception of occlusal appearance when evaluating the

need for orthodontic treatment in any society and therefore this study attempts to fill this gap.

AESTHETICS

INTRODUCTION

'Beauty is in the eye of the beholder'. This is often quoted as the standard by which the aesthetics of people and objects are judged. What we consider beautiful, attractive or a pleasure to behold, is determined by our preferences. The perception of beauty is not only an individual preference but is one that is governed by our social and cultural philosophies or norms and these may in turn be influenced by our training (Polk et al., 1995; Mantzikos, 1998).

Lifestyles and personal performances have been strongly influenced by the prevailing perception of facial attractiveness. People of high social ranking are often portrayed as having 'ideal' proportions (Peck and Peck, 1970).

THE HISTORY OF AESTHETICS

The term aesthetics appeared in the literature as early as 1753 in Alexander Baumgarten's "Reflections on Poetry" (Pepper, 1974). He had recognized the need to include sensory and perceptual cognition in certain areas of appreciation and, drawing on the Greek word for perception - *aisthetikos,* coined the word aesthetics for the science of perceptual cognition (Beder, 1971). It is interesting to note that the conception and development of the principles underlying the appreciation of those qualities that are pleasing to the eye dated back to the Ancient Greeks (Powell and Rayson, 1976).

Researchers in various fields of study including anthropology, fine arts and the healing arts have over the years shared a common interest in facial aesthetics. It is proposed that aesthetic awareness probably developed some thirty five thousand years ago in Paleolithic man. The Egyptians, five thousand years ago expressed their aesthetic attitudes in their different art forms. Ancient Greece is recognized as being the first society to give expression to the qualities of facial beauty through philosophy and sculpture (Peck and Peck, 1970). They also introduced mathematical descriptions by which beauty could be assessed. These declarations were based on the assumption that all beautiful creations conformed to mathematical and geometrical laws such as the golden proportion (Peck and Peck, 1970; Powell and Rayson, 1976; Ricketts, 1982). In their study on facial aesthetics, Peck and Peck (1970) reported that from the end of the fourth century A.D. harmonious proportions in art were no longer being governed by nature but by principles of moral significance. Aesthetics then began to be expressed in term of spiritual beauty.

This era was soon followed by the Dark Ages; a period during which any consideration of physical beauty and human body proportions continued to be suppressed. It was not until the Renaissance, in the fifteenth century, that Western Civilization reverted back to the classical traditions of Greek and Roman art. The works of Michelangelo typified this return to the classical nature of the art form (Peck and Peck, 1970). They also noted that art had seemingly traced a recurring pattern of "classical movement" followed by an "anticlassical movement" from the Renaissance to the present time.

FACIAL AND DENTAL AESTHETICS

INTRODUCTION

Aesthetics is a phenomenon of the intellect, dependent on cultural norms, which are often informed by ethnic recollection. It has been shown that a variety of social and cultural factors influence the perception of physical attractiveness. In each racial group there exists a set of values whereby specific facial characteristics, or features, are viewed by the majority as being pleasing to the eye. There also exists, within this, a sexual dimorphism in these appreciations (Bravo, 1994).

Facial and dental aesthetics is largely determined by cultural norms, the media, peer pressure and is also influenced by health professionals. Aesthetics, as determined by dentists and patients, takes into consideration good proportion, facial balance and harmony. Differences often emerge in the definitions of the aforementioned (Goldstein, 1969). Peck and Peck (1970) in their analysis of faces judged by the public as possessing attractive features found that these tend to have fuller, more protrusive dento-facial patterns than the cephalometric norms in contemporary use.

HISTORICAL PERSPECTIVE

The importance of facial aesthetics was recognized early in the history of orthodontics. John Hunter in 1803 suggested that the prime objective of orthodontic treatment was to beautify the appearance of the mouth (Goldman, 1959). Calvin Case and Edward Angle, who made significant contributions during the pioneering days of orthodontics, are widely quoted for their preoccupation with aesthetics, the fine arts and their influence on orthodontic thinking (Downs, 1948; Goldman, 1959; Neger, 1959). Angle in 1907 was one of the first to describe the face in the terms of balance,

harmony, beauty, and 'ugliness' (Bishara et al., 1985). He stated that, "the study of orthodontia is indissolubly connected with that of art in relation to the human face. The mouth is a most potent factor in making or marring the beauty and character of the face".

Angle's concept of facial harmony was further expanded on by Wuerpel, in 1932, who stated that faces, even though they are proportioned differently, can be beautiful providing that there is balance; which, according to him is the situation whereby one part of the facial pattern is not being overemphasized at the expense of another (Bishara et al., 1985). He further emphasized the need for the orthodontist to take into cognisance the facial type being treated namely, Greek, Roman, Greco-Roman, Semitic or Mongoloid and cautioned against distorting the face during orthodontic treatment. Bishara et al (1985) observed that early endeavours concerned the finding or establishing of harmonious relationships between the mouth and face. Despite this preoccupation with facial aesthetics, no attempts were made to quantify the static facial pattern until Simon (1926) formulated his technique of "Photostatics". Later followed by Hellman (1927) who noted that faces could be categorized into specific types, based on certain recognizable parameters. Downs (1948) concluded that there was a definite proportion of facial pattern for persons possessing excellent occlusions.

Tweed (1954) gave special attention to facial aesthetics and recognized the need for extraction in orthodontic treatment in an attempt to obtain an aesthetically balanced and stable dentition. It is interesting to note that Tweed placed aesthetics first on his list of treatment objectives, and was convinced that good occlusion was possible only where there was a reasonable balance between the various components of the dento-facial complex. Though he proposed the use of his "diagnostic triangle" in treatment planning and diagnosis, Tweed believed that the "Eye of the

Orthodontist" should become the deciding factor in determining whether the desired facial harmony had been achieved.

Despite their almost universal usage of the term aesthetics, Lusterman (1963) found that most orthodontists differed in their ideas and ideals concerning this. Many definitions of aesthetics in the literature are associated with an underlying principle whereby certain attributes are given precedence over others by the perceiver (Goldstein, 1969; Powell and Rayson, 1976). Aesthetic judgment is influenced by the information available to and the experience of the individual, which enables them to relate, compare, cross-refer, collate, and weigh the cues in formulating an outcome. This judgment needs to be objective in its evaluative standards if it is to be shared by other people (Goldstein, 1969).

Facial harmony and the interrelations of the dento-facial complex, while consistently attracting the attention of the dental profession, has always been an elusive concept. This is due to the diversity inherent in the morphogenetic facial pattern and also due to the indefinite nature of aesthetics (Goldman, 1959).

NORMAL OCCLUSION

Many investigators have attempted to define normal occlusion (Angle, 1899; Stoller, 1954; Begg, 1954; Ackerman and Proffit, 1969; Andrews, 1972; Baume and Marechaux, 1974). Angle proposed a classification, which was readily accepted by the dental profession as it brought order to the confused state of dental relationships (Proffit et al., 1992). A major shortcoming of this postulate was that it assumed the position of the maxillary molar to be static (Stoller, 1954; Akapata and Jackson, 1979). Stoller (1954) expanded on Angle's classification by relating the upper first molar to both the lower first and second lower molars. Andrews (1972) contributed to this debate by defining his six keys of occlusion; and

although he perpetuated the static concept he challenged the manner in which orthodontists had been obsessed with the use of only the molar relationship and inter-incisal angle in their assessment of occlusion.

Furthermore, a major problem encountered in defining normal occlusion is the assumption that it is synonymous with ideal occlusion (Lombardi and Bailit, 1972; Lombardi, 1982).

In the biologic sense, normal occlusion implies a range of variation in tooth alignment and jaw relationships, which is compatible with normal function and the absence of disease (Lombardi and Bailit, 1972; Lombardi, 1982). A more apt definition would be that normal occlusion is one within the accepted deviation from the ideal that does not constitute functional or aesthetic problems (Houston and Tulley, 1986). No clearly defined limits describe the range of normal occlusion. The profession is thus faced with the problem of not knowing how far from the norm the occlusion must deviate to be termed a malocclusion.

For a particular population the definition of normal occlusion has to be a statistical one. It should include a range of acceptable variation compatible with health and normal function (Lombardi, 1982). This assertion provides an important argument in the support of research directed at establishing the range of normal occlusions in the local setting.

Orthodontic treatment goals, however, continue to be based on the ideal static occlusion as expounded by Andrews (1972) and often any deviations from this is not regarded as excellence in orthodontic treatment.

MALOCCLUSION

Both the descriptions and the definitions of malocclusion have been subject to considerable variation. The definition ranges from the simple, "crooked teeth", found in popular publications to the more complex models (World Health Organization, 1962; Salzmann, 1966; Baume and Marechaux, 1974).

Malocclusions are deviations from the normal that may be considered aesthetically or functionally unsatisfactory (Houston and Tulley, 1986). Numerous other definitions of malocclusions also exist (World Health Organization, 1962; Salzmann, 1966; Baume and Marechaux, 1974). Handicapping malocclusion and handicapping dento-facial deformity are conditions that constitute a hazard to the maintenance of oral health and interfere with the well being of the child by adversely affecting dento-facial aesthetics, mandibular function, or speech (Salzmann, 1968).

The problem with most of these definitions is that they do not indicate the cut off points between normal and malocclusion. Many of the definitions are imprecise so that what is defined as a malocclusion in one population group may be normal in another. It is suggested that a value judgment has to be made to determine the extent that a particular occlusion must deviate before it can be labeled a malocclusion. This value judgment should be based on clear criteria, which may include aesthetic values, body image, anatomical deviations from morphological norms as defined by clinicians, as well as the cultural and social norms of the community (Ferguson, 1988).

PERCEPTION

INTRODUCTION

The face can be described as the window of the mind and body as it is a region that is important in both communication and emotional display. The oral area is the one with which verbal and also some non-verbal communication occurs and represents the primary focal point during all interpersonal interactions.

Deformities of the facial region are very difficult to conceal or disguise as opposed to other parts of the body, which can be covered. Therefore a slight facial disfigurement such as a malocclusion can frequently produce psychological effects, which may be out of proportion to the extent or appearance of the disfigurement.

PSYCHOLOGICAL ASPECTS OF PERCEPTION

Psychologists have shifted the focus of their attention toward the study of morphological influences on behaviour and perception. This field of study has been referred to as the 'developmental social psychology of physical appearance' (Adams, 1977). Positive subjective evaluations of body morphology commonly referred to as physical attractiveness, can influence an individual's experience and have definite channeling effects on their social attributes, interactions, personality development and social behaviour. Berscheid and coworkers (1973) stated that people who are satisfied with their facial appearance appear to be more self-confident and have higher self-esteem than those who are not. Those who are not satisfied often express more dissatisfaction with their teeth than with any other facial feature

The psychological problems of the "deformed" person stem from two separate but interrelated processes (Stricker et al., 1979). The first being

society's response to the defect as in the case of malocclusion where people may respond to the defect with a lack of acceptance, ranging from mild amusement to utter dismay. The second is the individual's response to the deformity, which often is only partially related to the actual impairment introduced by the malocclusion.

Secord and Jourard (1953) felt that the most important effect the dentofacial defect has on the life of the individual might be the adjustment in behavioural patterns that has to be made to accommodate the defect. This hinges on the importance that the individual places on the teeth and oral region as cues to personality impressions compared with other somatic cues. Pitt and Korabik (1977) showed that people's perception of their facial profiles is determined by their overall perceptions of themselves. This refers to their psychological self-satisfaction with their appearance, rather than with their actual physical appearance. People who are badly adjusted to their disfigurement are constantly concerned that others are focusing on their disability.

PSYCHOLOGICAL CONCEPTS

The orthodontist measures physical characteristics with precision in terms of millimetres and degrees whereas psychologist measures it in less specific entities, such as verbal and social actions and attitudes (Tung and Kiyak, 1998).

A number of important psychological concepts are useful in the understanding of facial aesthetics. These include that of perception, self-concept, body-image, stereotypes, social identity and prejudice. As numerous definitions of these psychological concepts exist, those outlined by Papali and Olds (1992) are the ones this discussion will adopt.

Perception

Perception is the organisation of sensory data (sight, touch, hearing, taste, and smell stimuli) combined with the results of previous experience or beliefs. Part of perception consists of labeling the relationships between objects by various strategies, but this is done ultimately in reference to oneself. In interpreting a stimulus the person constructs a 'percept', which represents some of the conclusions, though unconscious, about that stimulus. The brain uses past experiences in developing these perceptual strategies.

Body Image

Body image may be defined as the mental picture that each individual has of their own appearance in space. This term is synonymous with self-image and is often interchanged in texts. Protection and enhancement of the self are prime human motives, self-love being a fundamental trait of mankind (Stricker et al., 1979).

Self-Concept

Self-concept is a collection of beliefs about one's own nature, unique qualities and social behaviour. It is defined as the perception of one's own ability to master or deal effectively with the environment (Novick et al., 1995).

The individual's interactions with and responses from others may influence the development of self-concept (Kiyak and Bell, 1990). Developmental psychologists generally agree that a child's self-concept develops from the reflected appraisal that it receives from others (Gecas, 1982). This also is dependant on the social comparisons and self-attributions made by the child. Figure 1 illustrates the variety of factors that may influence self-concept.

AGE INFLUENCES

Young Child   Parents
                         Teachers

Preadolescent   Peers
                         Perceived attractiveness
                         Perceived competence

SELF CONCEPT

Adolescent   Peers

Adult   Achievements
                         Social roles
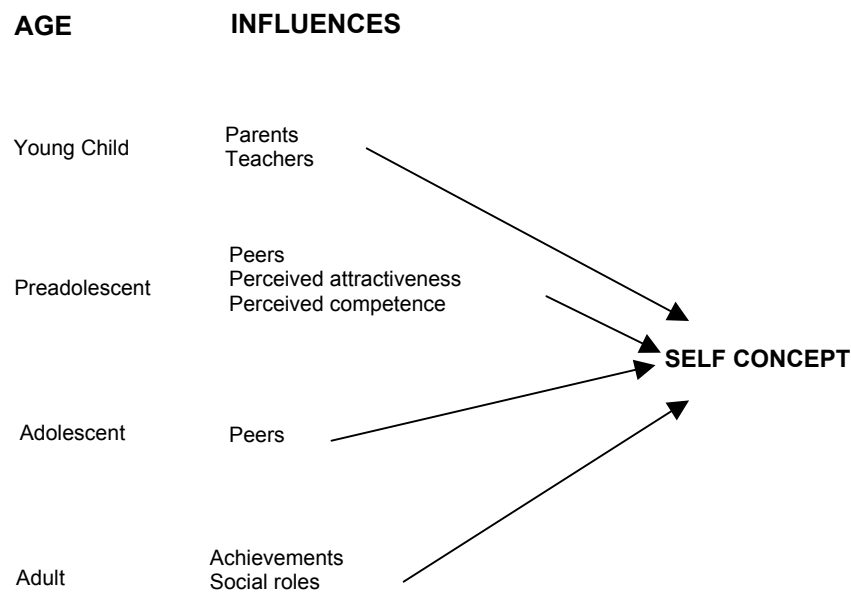
Figure 1: Social factors affecting self-concept

It is important to note that researchers have consistently found that self-concept is related more to the individual's perceptions of others' evaluations, than to their (others') objective evaluations (Gecas, 1982; Van der Zanden, 1985).

Females have consistently been found to have more negative body-image and self-concept scores. This phenomenon begins in adolescence, when girls become more concerned about their physical appearance and weight in particular. Although pubertal changes increase the self-consciousness of boys and girls, the latter are more influenced by these rapid changes in their physical appearance, and they continue to attach more importance to these external characteristics into adulthood (Klima et al., 1979; Albino and Lawrence, 1993).

Facial attractiveness plays an important role in social acceptance by peers. A positive relationship exists between facial attractiveness and popularity; which informs the favourable evaluation of one's personality,

social behaviour and intellectual expression by others (Albino and Lawrence, 1994). This in turn positively reinforces the development of the individual's self-concept. In contrast those that are less attractive are more likely to be mistaken in their self-evaluations (Cohen and Horowitz, 1970; Horowitz, 1971; Pitt and Korabik, 1977).

Although self-concept per se has not been found to be altered by orthodontic treatment; body-image and the appraisal of parents and peers, have been found to improve after treatment (Kiyak and Bell, 1990; Klima et al., 1979). In children with more conspicuous facial impairments such as cleft lip or palate, correction may result in improved school performance and social acceptance (Jones, 1984; Tobiasen et al., 1987).

Stereotypes

These are the widely held beliefs that people have certain characteristics because of their membership to a particular group or groups. The most common types in society are those based on gender or membership to particular ethnic or occupational groups. Stereotypes are broad, over-generalisations that ignore the diversity within social groups and foster inaccurate perceptions of people.

Physical characteristics of people tend to stimulate stereotypic expectations in others crediting them with specific behavioural attributes that may not exist. Individuals with low intelligence are often depicted as having Class II division I malocclusions with severe overjets. In contradistinction, an added pair of thick-lensed spectacles is indicative of superior intelligence and studiousness (Stricker et al., 1979).

Social Identity

This refers to the social categories that a person is recognised as belonging to. Some of these categories are assigned at birth, by gender, age, nationality, race and religion while others are added later in life.

Some of these categories are subject to change during life. Numerous pigeonholes exist into which society places its members and these elements of social identity constitute ways in which these individuals are seen and see themselves. The psychological problems of the deformed are social in nature in that the deformity becomes part of the patient's social identity (Stricker et al., 1979).

Prejudice

It is the negative attitude held towards a member or members of the group. Like other attitudes prejudice includes three components of belief, namely ideas (cognitive component), emotions (affective component) and predisposition (behavioural component). Prejudice may lead to discrimination, which involves behaving differently, usually unfairly, towards a member or members of a group. Perhaps no factor plays a larger role in prejudice than stereotype (Papalia and Olds, 1992).

People tend to ascribe positive personality characteristics to those who are good looking, seeing them as being more sensitive, kind, sociable, pleasant, likeable and more interesting than those who are considered unattractive (Dion et al., 1972). Facial characteristics often provide false clues to personality traits.

Children deemed to be attractive are perceived not only to be more socially accepted by their peers but they are also believed to be more intelligent and to possess better social skills (Goldman and Lewis, 1977; Langlois and Stephen, 1977; Adams and Crane, 1980; Van der Zanden, 1985) and receive more attention than their less attractive counterparts (Adams and Crane, 1980; Tobiasen, 1984). A teacher's perceptions of a child's attractiveness can influence the expectations and evaluation of the child (Kiyak and Bell, 1990; Dare, 1992).

In addition "attractive" people are considered, by their peers, to be more desirable as friends than are unattractive people (Van der Zanden, 1985). Employees perceived as more attractive by their supervisors are given better job-performance ratings than those less attractive (Landy and Sigall, 1974).

Studies of the public's responses to attractive and unattractive faces of strangers have shown that attractive people are described as more competent in interpersonal relationships and friendlier than people with unattractive faces, even when the test subjects had no additional knowledge about the faces being examined (Bull and Rumsley, 1988).

This trend persists throughout the life of the individual with the physically more attractive having an advantage over the rest of the population. Society thus appears to harbour prejudice towards people whose physical characteristics deviate from those of the majority, or the 'normal' (Stricker et al., 1979).

Eriksson's Theory of Psychosocial Development

According to Eriksson's theory (1968) of psychosocial development the pre-adolescent child experiences the stage of 'industry versus inferiority'. This is when social and academic skills develop, and children begin to compare their capabilities, in these areas, with their peers. It is a stage when they increasingly recognise that they can achieve competence through their own initiative.

The adolescent goes through a period of 'identity versus role confusion'; described as the Eriksson's fifth stage of psychological development. This is a period of role confusion for many adolescents as their physical selves mature into their future adult selves yet they are still treated as children. During this developmental stage the search for identity, or 'a feeling of being at home within one's body, a sense of knowing where one is going,

and an inner assuredness of anticipated recognition from those who count'
is experienced by the individual (Eriksson, 1968).

PERCEPTION OF AESTHETICS

FACIAL AESTHETICS

The face is the primary focus of identification and a rich source of non-
verbal information (Ekman, 1978). Facial aesthetics has been found to be
a significant determinant of self and social perceptions and attributions
(Albino et al., 1990). These perceptions of facial aesthetics influence
psychological development from early childhood to adulthood. The infant's
visual preference for human faces has been confirmed in many
psychological studies (Van der Zanden, 1985). This behaviour is adaptive;
recognition of familiar faces is critical for an infant's survival. By the age of
6 months, children can discriminate between familiar and unfamiliar faces
(Kagan, 1979). By the age of 6 years, children have internalised cultural
values of physical attractiveness and by 8 years, their criteria for
attractiveness are the same as those of adults (Carvior and Lombardi,
1973).

DENTAL AESTHETICS

In relation to facial aesthetics it has been shown that, from the point of
view of the patient, teeth are second in importance only to facial
complexion (Lew, 1993). An unpleasant dental appearance may have a
significant emotional impact on an individual's well being. It may also
adversely affect their self-esteem and evoke an unfavourable response in
many facets of their social interaction (Shaw, 1981). There is evidence to
indicate that a marred physical appearance provokes an unfavourable first
impression and can affect judgments of social acceptability. The face and
oral region in particular, appear to be of primary importance in determining

attractiveness and the teeth are a frequent target for teasing and ridicule amongst children (Shaw et al., 1980). Well-aligned teeth and a pleasing smile are associated with positive status at all social levels, and irregular or protruding teeth are associated with a negative status (Shaw, 1981; Shaw et al., 1985).

SELF-PERCEPTION AND TREATMENT DEMAND

Introduction

The perception of orthodontic treatment need is mainly based on anatomical or functional features of the occlusion, but of primary importance in determining individual therapeutic measures is the self-perception of dental appearance (Albino et al., 1990). Most people undergo orthodontic treatment to improve their dental appearance but it is mainly aimed at cosmetic improvement, which many orthodontic patients and their parents believe will enhance individual's social acceptance and self-esteem (Shaw et al., 1979; Burden and Pine, 1995). To the patient, the psychosocial benefits of treatment often prevail over improvements in function and dental health (Brook and Shaw, 1989).

Most individuals who have had orthodontic treatment feel they have benefited, even though dramatic changes in facial appearance are not always evident (Ostler and Kiyak, 1991). Support for these views comes from studies that have demonstrated links between dentofacial appearance and social attractiveness (Shaw et al., 1985). The more attractive one's external appearance is, the greater the likelihood of receiving positive peer appraisal, which supports a positive internal self-image (Jacobson, 1984).

Self-Perception and Occlusal appearance

Studies that have evaluated the self-perception of dental characteristics indicate that the general public is generally aware of dentofacial

abnormalities, particularly excessive overjet. They ranked the following classes from most to least attractive: Class I, open bite, Class II, and Class III (Dongieux and Sassouni, 1980) however patients with Class II malocclusion have been found to be significantly more motivated to seek treatment than Class III patients (Wilmont et al., 1993). Contrary to the findings of these studies research amongst Asian subjects revealed a different pattern of perceived dental attractiveness. Soh and Lew (1992) found, in Singapore sample, that Class III malocclusion was ranked as more attractive than Class II.

Malocclusions consisting of overjet, deep bite and overcrowding have been associated with the most negative self-evaluations among Danish adults (Helm et al., 1985) which has been suggested as the most common factor influencing the decision to seek treatment (Gosney, 1986; Spencer et al., 1995). Perceived facial appearance has also been found to be an important factor of the decision to undergo facial surgery for improvement of dental appearance (Kiyak and Bell, 1990).

With increased severity of the problem, there is an increasing level of self-recognition (Howitt et al., 1967). While dissatisfaction with dental appearance is broadly related to the severity of the occlusal irregularities (Albino et al., 1981), there are differences in recognition and evaluation of dental features. There can also be a discrepancy between perceived malocclusion and satisfaction with the teeth (Shaw, 1981; Horup et al., 1987). A person may consider the teeth to be malpositioned and yet be satisfied with the dentition. Others can be dissatisfied with their dento-facial appearance without wanting to have any treatment. Therefore the person's perception of their dentition and their demand for treatment is of considerable importance in determining whether treatment is offered or not (Myberg and Thilander, 1973; Ingervall and Hedegard, 1974; Malmgren, 1980; Shaw, 1981; Horup et al., 1987; Burgersdijk et al., 1991).

Several studies have made specific attempts to estimate how accurately individuals, of all ages, perceive their own dentition (Espeland et al., 1991; Phillips et al., 1992). Shaw (1981) found that children with less perceptual awareness tended to be dissatisfied with their dental appearance and perceived a greater need for orthodontic treatment. In contrast to this, in a study comparing schoolchildren in Wales and Kentucky, Tulloch and others (1984) showed that perceptions of dental attractiveness and treatment need were similar. However, subtle differences were found, with the American children having a more realistic perception of treatment time, which is probably attributable to their greater exposure to the concept of orthodontic treatment. Numerous studies have suggested that teenage children have developed an oral perceptual awareness (Shaw et al., 1975 and 1980; Lindsay et al., 1983; Tulloch et al., 1984; Roberts et al., 1989).

Defects in physical appearance may be imagined or real. Studies have revealed a discrepancy between individuals' views of the acceptability of dental appearance and those of the dental assessors. Some subjects under-estimate the severity of their irregularity (Goldstein, 1969; Myberg and Thilander, 1973) while others express dissatisfaction with objectively good occlusion (Howitt et al., 1967; Lewit and Virolainen, 1968; Shaw, 1981). Self-satisfaction with teeth and objective evaluations of dentofacial form show a degree of correlation. Other factors, such as psychosocial factors may be superimposed on the satisfaction decision (Stricker, 1970; Weiss and Eiser, 1977). Horowitz and colleagues (1971) compared children's preferences for various occlusal conditions with their self-perceived occlusion and found that the majority, regardless of sex or race, ranked the ideal occlusion highest. However, there was some correlation between self-perceived occlusion and preference. Similarly Prahl-Andersen and coworkers (1979) found in their evaluation of dental attractiveness that the general public seems to agree that the orthodontic "ideal occlusion" is the most aesthetically pleasing.

23

In a study conducted by Onyeaso and Arowojolu, (2003) to determine treatment need and demand among untreated Nigerian adolescents, they observed that some subjects who had near ideal occlusion felt the need for treatment while some who had handicapping occlusion felt otherwise. In Tanzanian children (Mugonzibwa et al., 2004) it was found that severe malocclusions were perceived as being the most unattractive. They observed that children who exhibited a need for treatment also had a high demand for treatment.

Social Factors

Over the past two decades several investigators have studied the effect of social factors on attitudes toward orthodontic treatment (Shaw et al., 1979; Tulloch et al., 1984; Gravely, 1990; Shaw et al., 1991b). The demand or perceived need for orthodontic treatment is greatest in females, among white subjects, in urban populations and among children of higher socioeconomic status (Holmes, 1992; Wheeler et al., 1994). In contrast actual treatment need was found to be greater for males and whites and equal across socioeconomic strata and the same in urban and rural settings (Wheeler et al., 1994).

In Asian subjects the demand for orthodontic treatment had been found to be inversely correlated with the rank order of attractiveness of the malocclusion. In descending order of attractiveness; those children presenting with Class I open bite; Class III and Class II with anterior crowding and deep bite malocclusions ranked themselves as increasingly more likely to need treatment (Soh and Lew, 1992).

It has been hypothesized that the labeling of a broader range of people as aesthetically unacceptable in a social context becomes possible only when the prospect of remediation exists and that the advances in technology precipitates an increase in the number of people, especially children, seeking orthodontic services. Perhaps the availability and willingness of

orthodontists to perform treatment raises the expectations of those who would otherwise adapt successfully to their dentofacial appearance. Pressures to conform are likely to be reinforced with orthodontic appliances being regarded, at least in the United States, as "practically a badge of honor, a symbol of beauty, endurance and wealth" (Baldwin, 1980).

Treatment Seeking Behaviour

The Health Belief Model (Rosenstock, 1974) that has been formulated to express the various interactions involved in treatment-seeking behaviour, can, with some modification and extension, provide a reasonable framework for considering the utilization of orthodontic services. The possible contribution of the immediate and general social context towards the treatment decisions of the individual is outlined in figure 2. The various steps of recognition, perceived seriousness, treatment possibilities, barriers, and cues to action will, in the case of orthodontics, be moderated
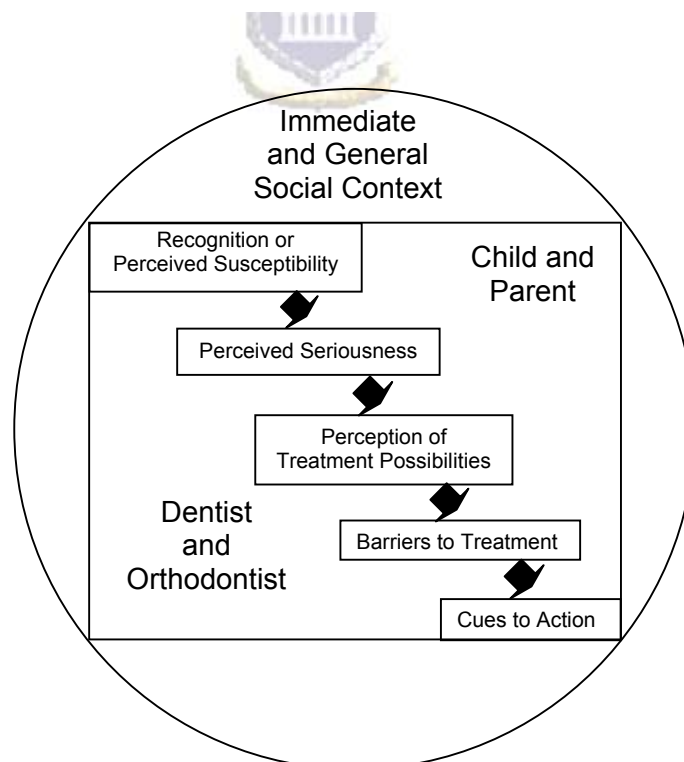
Figure 2. Schematic representation of suggested influences on the formulation of treatment decisions (Tulloch et al., 1984,).

by both child and parent and also by advice from and action of the dentist and orthodontist.

Children

The decision of whether to treat a patient in childhood or adolescence raises several issues, which may be related to their respective developmental stages (Weiss and Eiser, 1977; Cucalon and Smith, 1990; Southard et al., 1991). One of these is the concern regarding co-operation with treatment, which is influenced by sex and age. Girls and preadolescent children are likely to be more co-operative than boys and adolescents and for this reason it is suggested that treatment begin after age of 6 and be completed before the onset of puberty (Southard et al., 1991). Other factors, which positively influence co-operation, include high self-esteem, optimism regarding the future, and low social alienation (Cucalon and Smith, 1990).

Adolescents

Adolescence is often associated with increased self-consciousness, confusion about identity and acceptance by others, and concerns about recognition from adults and peers. Younger children are influenced greatly by their parents and other adults, including teachers and health care providers, whereas in the case of adolescents peers assume a greater role in their lives, especially in terms of self-image (Van der Zanden, 1985). Peers often serve as a standard of comparison and implicit or explicit critics of the adolescent's appearance, dress, activities, and interests. The ambiguity and fluidity of these peer relationships and the reliance on peer acceptance and ambivalence about parental authority can lead to social alienation but can also provide adolescents with important challenges that help them achieve a sense of identity or 'inner assuredness'. Indeed, the social, emotional, and often, academic crises of adolescence are viewed by some personality theorists as a healthy process of reconstructing one's identity and self-concept (Eriksson, 1968; Freud, 1958). Other

developmental psychologists have found that self-concept does undergo some changes during adolescence but that these changes are not necessarily traumatic (Waterman, 1982; Blyth and Traeger, 1983).

The increasing significance of peer acceptance for adolescents results in greater need for social comparison. Girls in particular express greater concern about their facial features, especially when some (teeth, nose, and hair) are different from those of their contemporaries. Boys are not immune to the social comparison process, but are more likely to express concerns with their athletic ability and physical size compared with their peers (Tung and Kiyak, 1998).

This increased focus on the self relative to peers may help or hinder the patient's success with orthodontic interventions. If the adolescents have significant concern about the appearance of their teeth and have friends who are undergoing or have undergone orthodontics, they could view them as role models, which could result in greater cooperation with the treatment regimen. If, however, the child is absorbed in other developmental tasks of adolescence, it may be the wrong time to initiate treatment.

Research by Peevers (1987) on children's past, future, and current perspectives and their perception of change versus constancy in them provides further evidence that adolescence is a time of identity confusion. They analysed the self-descriptions of children aged 6, 9, 13, and 17 years which were coded in terms of chronological continuity, distinctness of the self as a unique being, and self-reflection. Distinctness was least evident at age 6 and most evident at ages 9 and 13 years. Self-reflective descriptions did not emerge in children until age 17. These differences may have implications for children's attitudes toward orthodontic treatment. Adolescents focused on the 'here and now' may have more difficulty with long-term adherence in the interests of future improvements in their oral function and appearance.

Adolescence is the period of biologic growth that involves dramatic physical, sexual, emotional, and cognitive changes, sometimes resulting in negative responses to physical appearance. Concern that adolescents have about their dentofacial appearance may be more intense than those of adults. Awareness of any negative aspects may even be exaggerated due to peer pressure on the adolescent to appear attractive (Albino and Lawrence, 1993). Adolescents who had orthodontic treatment were found to have a better quality of life than those who were undergoing or never had treatment (De Oliviera and Sheiham, 2004). It can be seen that psychosocial variables can have both a direct and an indirect effect on the perception of malocclusion, which is therefore of considerable importance with regard to treatment demand.

<u>Adult Perception</u>

The need and demand for orthodontic care for the adult is unpredictable. It fluctuates through an individual's life due to different 'life cycle events' including change in wealth and social conditions. Need and demand for orthodontic treatment are also influenced by the dental development, facial growth, social awareness and culture, as well as by dentist interventions due to dental decay and loss of teeth.

This demand, in adults, seems to decrease over years even without treatment (Helm et al., 1985).

Societal Perceptions

With respect to facial and dental aesthetics, the attractive stereotype differs from region to region, with the cultural background of the people often determining its nature. Researchers have examined cross-cultural differences in the perception of facial aesthetics and have found similar ratings between Britons and Americans (Tulloch et al., 1984), East Germans and Australians (Cons et al, 1983). In all these studies Caucasian facial form was the most preferred type and hence the consistency across ethnic groups in their perceptions of facial aesthetics.

However, it should be borne in mind that most of these population groups had their origins in Europe and this may account for the similar ratings. Conversely, Blacks subjects prefer protrusive profiles (Samsodien, 1986) while Class III relationships were the ones of choice amongst the Oriental populations (Soh and Lew, 1992).

Studies reporting on the perceptions of malocclusion found that they differ among various racial groups and cultural circumstances (Tedesco et al., 1983; Cons et al., 1983; Tulloch et al., 1984). In contrast, a study conducted by Kiyak (1981), of the relationship between racial and individual features and their effect on the dental aesthetic values of Pacific Asians and Caucasians were examined, noted that while individual differences emerged, aesthetic ratings were not related to racial type or to the individual's own malocclusion.

Few studies have addressed the perception of occlusal characteristics in the African cultural context. The perception of dental aesthetics of the Nigerian students was found to be very similar to those of American student groups. However it was found that median diastema were significantly disliked in 'whites' but it was considered desirable and a sign of beauty in many African populations (Baume and Marechaux, 1974; Helm et al., 1986; Otuyemi et al., 1998; Kerusuo et al., 1995). Certain societies mutilate, distort, or alter parts of their anatomy to enhance their concept of beauty such as the grinding of incisor teeth (van Reenen, 1985). This mutilation of front teeth may also show an individual's position in the social hierarchy or provide group identification.

The studies done in Kenya (Ng'ang'a et al., 1996 and 1997) have empirically determined the prevalence of malocclusions. However, if a scale of determination of the severity of the occlusal features is to be established, which is necessary for treatment prioritization, it is imperative that the perceptions of dental appearance in the Kenyan community be

investigated. In this way the perceived severity of the actual malocclusion in the community may be quantified (Shaw and Robertson, 1975). This is relevant for the planning of orthodontic service and allocation of limited resources (Foster et al., 1976). This can in turn be used to influence decision making on human resource training needs, continuing education, public health programs and screening for treatment priority.

PROFESSIONAL PERCEPTION AND TREATMENT NEED

Introduction

The implication of the elective nature of orthodontic treatment on the provision of this service is that professional standards, based on the biomedical sciences, have to be supplemented by the consideration of other factors in the establishment of treatment need and goals, and its implementation. For the authorities, the availability of economic resources and personnel constitutes an important consideration in the structuring of the orthodontic service. On the other hand, the individual's concern for their own dental appearance represents a decisive factor in the demand for treatment and assessment of treatment goals.

Treatment Need

Orthodontic treatment appears to be an area where the objective and subjective need for treatment are not identical (Kunzel, 1987; Wheeler et al., 1994). Depending on the study populations and research methodology, previous studies have demonstrated contradictory findings in the correlation of objective and subjective treatment needs. The public have in some studies estimated their treatment need as being relatively close to the opinions of dentists (Lindegard et al., 1971; Millen et al., 1986), although their criteria and preferences can be very different (Prahl-Andersen, 1978; Prahl-Andersen et al., 1979; Shaw, 1981). In other studies, the estimates of subjective treatment need among adolescents and adults have been significantly lower than the estimates of objective

need (Ingervall and Hedegard, 1974; Ingervall et al., 1978; Burgersdijk et al., 1991).

The general public clearly does not view malocclusion in the same way as orthodontic professionals (Prahl Andersen, 1975; Shaw et al., 1975). The study by Katz (1978) failed to find a meaningful association between subjects' level of satisfaction with dental appearance and any of the currently used orthodontic indices. Also in a study by Bearn and Wright (1996), they found that treatment decisions by dentists did not concur with the guidelines in use in the United Kingdom.

The role that culture plays in determining what is considered normal in any given group is often overlooked. The judgment of facial aesthetics is subjective and is undoubtedly dependent on various factors such as the social, geographic, and psychological backgrounds of the person. It is incumbent on orthodontists that they should consider all these variables when establishing a diagnosis and formulating a treatment plan (Cross and Cross, 1971).

The professionally determined need varies widely and depends on the criteria used, which could include; age, gender, type of population studied and the 'cut-off' levels for severity of malocclusion. The health care professionals may not possess a high degree of sensitivity to the patient's perceptions and this may be further aggravated if the professionals and patients are not from the same cultural background (Giddion and Hershon, 1974; Hall et al., 2000).

While it is the responsibility of dentists to offer advice on the dental implications of malocclusion, a greater exchange of opinion is possible with regard to judgment of appearance. It seems likely that dentists, and particularly orthodontists, operate a more critical dental aesthetic scale than society in general (Prahl-Andersen, 1978). There may, however, be

considerable variations between dentists in the extent to which these standards will be imposed in recommendations for treatment of the individual. The dentist or orthodontist, however, will seldom dispute the justification for orthodontic treatment where this is proposed by a child or parent. Thus the need felt by the children and parents would form a persuasive element in the allocation of resources.

Interaction of Treatment Need and Demand

The interaction of patient's need, as assessed by the professional with patients demand for orthodontic treatment is shown (Figure 3).

Need And Demand For
Orthodontic Treatment
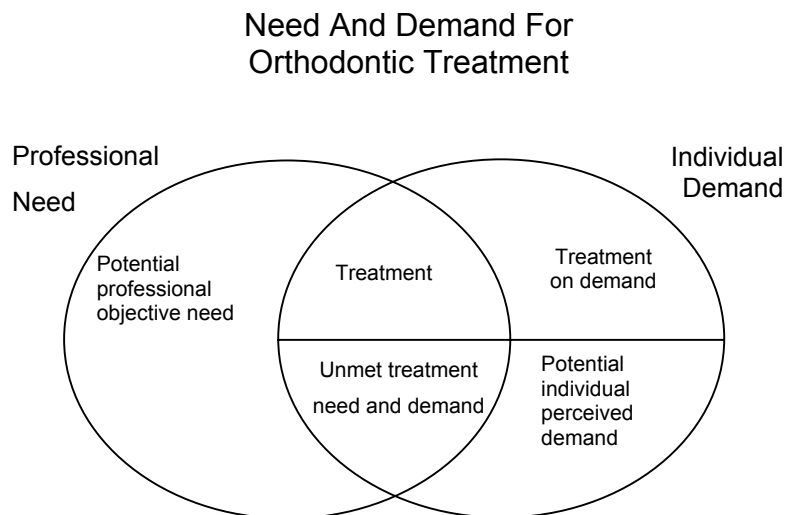
Figure 3: Interaction of Need with patient's Demand for
Orthodontic treatment (Jones and Oliver, 2000)

If the professional indicates a need for treatment and the individual desires treatment then the treatment can progress particularly, in an environment where there are appropriate resources such as appropriately trained staff, facilities and materials exists.

However, if the resources are either not available or are insufficient, an unmet treatment need and demand will result.

If the professional determines a need in the individual but the individual does not wish to have treatment then this is termed a 'potential professional objective need'. These individuals may or may not wish to proceed with treatment at a later date

In a situation where the individual perceives a problem but there is no significant objective need assessment the practitioner may still choose to enter treatment to satisfy that demand.

However, if the practitioner refuses treatment there will be a 'potential individual perceived demand' for orthodontic care.

MEASUREMENT OF PERCEPTION

INTRODUCTION

State-funded orthodontic programs are faced with enormous demands for treatment that often are not related to the severity of the malocclusion. There may also be a lack of concordance between the psychosocial impact of the malocclusion, on the individual, and the severity of the malocclusion itself. The Fédération Dentaire Internationale (1970) noted that there is no objective way of evaluating these factors in relation to the disharmonies of occlusal traits. A precise method to determine or predict when the malocclusion may become a social handicap for the individual also does not exist (Draker, 1960; Cons et al., 1983). Priorities for the provision of state-funded orthodontic programs need to be established. Jenny and co-workers (1980) advocated that cut off points should be determined on a scale of social acceptability instead of being determined by the individuals' perceived needs or desire for treatment; occlusal conditions should therefore be rated by the society at large to determine the levels of acceptability. Thus when an individual's physical attributes deviate too far from these socially defined norms; and the likelihood that

the person may be disqualified from full social acceptability that condition may then constitute a handicap.

INDICES

Whilst many indices exist to record malocclusion, it is important to distinguish those that classify malocclusions into types (Angle, 1899) and those that record prevalence in epidemiological studies (Bjork et al., 1964), from the indices that attempt to record treatment need or priority. Furthermore, indices used to record treatment success and treatment difficulty will have differing requirements.

There are numerous indices of malocclusion, which provide qualitative or numerical assessments of the occlusal state of the individual (Draker, 1960; Howitt and Shaw, 1977; Salzmann, 1968; Summers, 1971), which that been used as administrative tools in public health and epidemiological surveys.

Indices have been used to measure orthodontic treatment need from a clinician's viewpoint providing measurements, which are important for health services planning and monitoring of population trends. These rank people in order of the severity of their malocclusion. Other approaches to assessing desire for treatment have ranged from simply asking people whether they would like to obtain orthodontic treatment to more detailed questionnaires.

It would be useful if these indices could be used in the prioritization of orthodontic treatment. Yet none of the current indices are able to do this without first obtaining some idea of the ranking of occlusal traits within the community. A measure of dentofacial attractiveness is absent in most of them and also no information regarding the psychosocial effects of the malocclusion is elicited (Katz, 1978). Likewise there is a failure to take into

account the social and cultural background of the individual. Assessment of the aesthetic values of individual traits on a dental attractiveness scale is complicated by the prevalence of concurrent traits. Helm and coworkers (1986) suggested that an overall assessment of dental attractiveness would add validity to the assessment of occlusal conditions.

Little is known about the factors determining perceptions of occlusal state of an individual. The construction of a reliable method for assessing attitudes toward malocclusion and orthodontic treatment appears to be a necessary first step in understanding individual response to dentofacial malrelationships. Previous indices were not designed to quantify treatment need.

INDEX OF ORTHODONTIC TREATMENT NEED (IOTN)

Since its inception Angle's classification has been the most popular assessment of malocclusion and is still being used universally despite its shortcomings. Numerous indices have been proposed and tested since then but none of the earlier indices measured the aesthetic factor objectively. The late eighties saw a trend in the development of indices emphasizing the incorporation of both dental health and aesthetic components. The major problem with the aesthetic component is that it may be specific to a particular region or cultural group. These indices have to be 'calibrated' or 'modified' for different population groups as perceptions differ, from region to region.

In tracing the evolution of orthodontic indices it becomes apparent that recently indices have begun to reflect the importance of determining orthodontic need and the prioritization of treatment. This, however, requires that every dental professional recommending orthodontic treatment for patients should view the problem holistically. They, therefore,

should do so with an appreciation of the aesthetic, psychological, social, functional, and health benefits.

THE DEVELOPMENT OF THE IOTN

There have been many attempts to develop indices of treatment need, based on a patient's dental appearance Dental Aesthetic Index-DAI (Jenny and Cons, 1996), or to modify existing indices by incorporating an Aesthetic Component like the Aesthetic Component of the IOTN (Brook and Shaw, 1989).

The IOTN was introduced by Evans and Shaw in 1987 as a combination of the SCAN scale (Standardized Continuum of Aesthetic Need) and the index used by the Swedish Dental Health Board (Linder-Aronson, 1974) which was subsequently modified by other researchers (Richmond et al., 1992; Lunn et al., 1993). The index comprises two parts namely the Dental Health Component (DHC), which ranks malocclusions in terms of the significance of tooth irregularities for a person's dental health and the AC, which takes into account the aesthetic impairment.

The opinions of 74 dental professionals were used to validate the cut-off points representing the different levels of orthodontic treatment need. This approach of using the subjective opinion of clinicians to verify treatment need thresholds is not unique and was used by earlier workers to validate other occlusal indices (Salzmann, 1968; Summers, 1971; Jenny et al., 1983). Since its introduction by Brook and Shaw (1989) the IOTN has been widely embraced by orthodontists throughout the world (Shaw et al., 1995).

THE AESTHETIC COMPONENT

The AC consists of a 10-grade scale illustrated by numbered colour intra-oral photographs. The photographs represent three treatment categories:

'no treatment need' grades 1 to 4, 'borderline need' grades 5 to 7, and 'great treatment need' grades 8 to 10 (Evans and Shaw, 1987; Brook and Shaw, 1989). It is used to record the aesthetic impairment of the malocclusion to the individual.
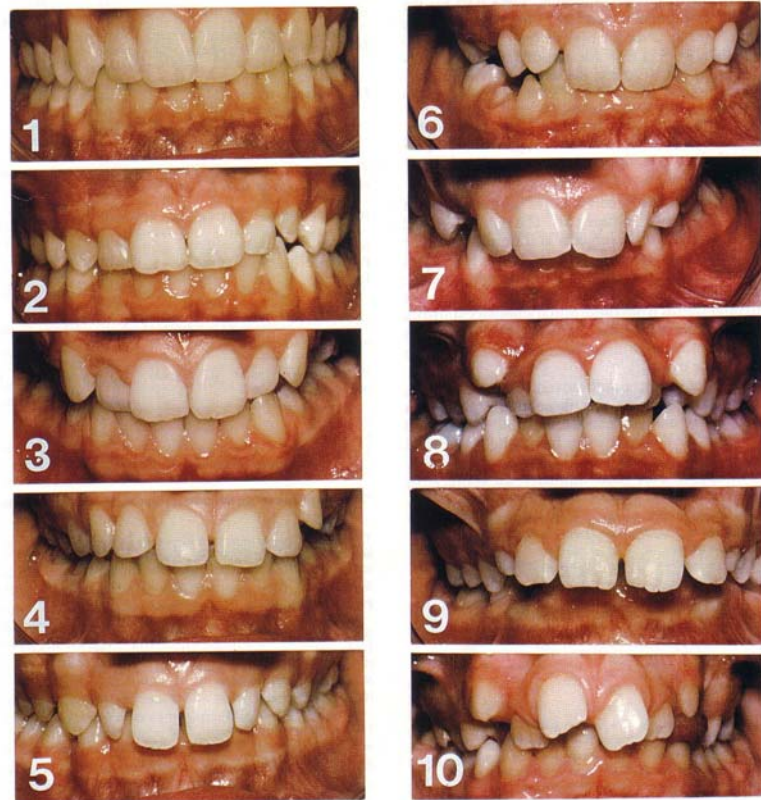
Figure 4: The Aesthetic Component (AC) of Index of Orthodontic Treatment Need.

The scale was constructed by using the dental photographs of 12-year-olds collected during a large multi-disciplinary survey (Evans and Shaw, 1987). Six non-dental judges rated these photographs on a visual analogue scale, and at equal intervals along the judged range, representative photographs were chosen giving a 10-point scale from 0.5 (attractive) to 5.0 (unattractive) dental appearance. The score reflects treatment need on the grounds of aesthetic impairment and by inference the socio-psychological need for orthodontic treatment. Grades 1 to 4 reflect no or slight treatment need, 5 to 7 moderate or borderline treatment need, and grades 8 to 10 a definite treatment need. The aesthetic

component, although separate from the dental health component, is sensitive to the needs of the individual and should direct treatment decisions (Cons et al., 1986).

SHORTCOMINGS OF THE IOTN

The aim of the IOTN is to identify those individuals who would be most likely to benefit from treatment (Shaw et al., 1991). However, the results of orthodontic therapy depend not only on malocclusion type and intensity, but also on appliance selection and the orthodontist's qualifications and experience (Fox et al., 1997; Bergstrom et al., 1998) as well as patient cooperation (Prahl-Andersen et al., 1979; Shaw et al., 1980; Shaw and Addy, 1986). A patient's readiness to co-operate and motivation should be taken into account during the assessment of treatment need. These factors are not included in the components of the IOTN.

Another setback of the AC of the IOTN is that it does not accommodate features of Black individuals. A modification is necessary to include features common to individuals with bimaxillary protrusion such as anterior open bite, anterior diastemas and reverse overjet (Trottman and Elsbach, 1996; Lunn et al., 1993). Therefore, the following modifications are necessary:

1. Anterior diastemas
2. Anterior crossbite or reverse bite
3. Anterior open bites
4. Class III malocclusion with edge-to-edge incisor relationship

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. Their findings were 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.

CONCLUSION

In orthodontics, the term 'healthy' should be viewed holistically which would include the psychological, social and cultural well being of the individual. The aesthetic component of the IOTN may be a good indicator of an individual's perception of their level of dental attractiveness and occlusion than questioning alone can reveal (Holmes, 1992). This is particularly useful when orthodontic resources are limited and any evaluation must be sensitive to what is available.

The need for Orthodontic treatment in Kenya has been documented in the literature using the IOTN (Dental Health Component) and Norwegian Orthodontic Treatment Index (NOTI), however, very little or no information is available regarding aesthetic need for children.

CHAPTER THREE:
AIM AND OBJECTIVES

AIM

To compare the subjective perceptions of the occlusal appearance of 11-12 year-old school children with the modified IOTN AC scale.

OBJECTIVES:

1. To assess the children's perception of their occlusal appearance.
2. To categorise the occlusal appearance using the modified IOTN AC scale by both children and researcher.
3. Compare the children's perception against the IOTN.

CHAPTER FOUR:
RESEARCH METHODOLOGY

INTRODUCTION

This project investigated the perception of occlusal appearance in a sample of Nairobi school children.

The material and methods for this study will be discussed under the following headings:

1. Population Sample and study design
2. Sample Size determination
3. Subject selection
4. Materials
5. Pilot Study
6. Measurements and Data collection
7. Data analysis
8. Legal and Ethical considerations
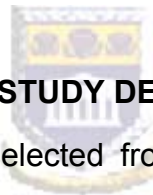
POPULATION SAMPLE AND STUDY DESIGN

The population sample was selected from a pool of 11 to 12 year-old children in the public schools of the Nairobi City Council.

The study design was cross-sectional in nature with both analytical and descriptive components.

SAMPLE SIZE DETERMINATION

The sample size was computed using Epi-info 2002. The number of the 11 and 12 year-old school children in public schools of Nairobi was estimated to be 25000 from the register obtained from the Education Department of the Nairobi City Council. The expected frequency of poor perception was projected to be 30%, the worst expected was 25%; these projections were based on study by Ng'ang'a and colleagues (1997) in which subjective perceptions of the same school children was found to be 33%. Computation of sample size was found to be 322. An inflation clustering factor of 50% was factored in since the study was to be carried out in

schools by cluster sampling method, giving an ultimate sample size of four hundred and eighty three.

SUBJECT SELECTION

The sampling was done by using a combination of both multi-stage and cluster random sampling methods. The schools were listed in each of the eight administrative zones of the Nairobi City, using records from the Education department. At least one school was randomly selected in each zone. The targeted children of ages 11 and 12-year-old were mainly in either grades 5 or 6, and each school had at least more than four streams of the grades. A class or grade was then randomly selected in each of the selected schools.

SELECTION CRITERIA:

1. Age of between 11 to 12 years at the time of the study
2. Resident and schooled in Nairobi from pre-primary level
3. Written consent from parents and guardians
4. Established permanent dentition
5. All those who had not received any orthodontic treatment

MATERIALS

This study was partly funded by Kenyatta National Hospital, Nairobi Kenya.

The materials required included the following:

1. Stationery (Questionnaires, consent forms, dental report forms and pens)
2. Colour Album of the modified AC photographs
3. Disposable spatulas

QUESTIONNAIRE

The respondents were interviewed and their responses were captured using two methods:

    a) Verbal Descriptor Response (VDR)

    b) Visual Analog scale (VAS)

The questionnaire consisted of three questions that attempted to capture the subject's perception of their dental appearance, comparison of their teeth with peers and how they rate their occlusion (Appendix 1). This was administered by the two assistants in the classrooms on the scheduled days.

With question two, in which teeth of children were compared with those of peers, the first option 'very good' was found to be inappropriate for comparative purposes and hence it was condensed with the 'better' category for both the VDR and VAS.

A) VERBAL DESCRIPTOR RESPONSE (VDR)

The responses were recorded using a four verbal descriptor scale: 'very dissatisfied', 'dissatisfied', 'satisfied', and 'very satisfied' for questions 1 and 3. For question 2, there were initially four responses that were later condensed into three: 'worse', 'similar', and 'better'.

B) VISUAL ANALOG SCALE (VAS)

Each question had a visual analog scale to capture responses. The scale was continuous from zero to one. The subjects marked on this continuous scale how they rated their teeth, anchored with terms 'most negative' and 'most positive'. The researcher, using a ruler recorded the interval level data (Appendix 1).

PHOTOGRAPHS

The colour photographs of the anterior of the modified aesthetic component (AC) of the Index of Orthodontic Treatment Need (IOTN) were used to capture the visual perception of dentition. The AC scale was created on the basis of intra-oral photographs of the dentition of 12-year old children (Evans and Shaw, 1987) and thus this study focuses on this age-group.

MODIFICATION OF AC PHOTOGRAPHS OF THE IOTN

Modification was necessary to accommodate the features of the subjects of African ancestry (Lunn et al., 1993; Trottman and Elsbach, 1996; De Mûelenaere et al., 1998). The following modifications were done by a panel of orthodontists at the University of the Western Cape and it incorporates the following features (see Figure 5):

1. Anterior open bite
2. Anterior crossbite
3. Upper median diastema
4. Edge-to-edge incisor relationship

Figure 5. Photographs of bimaxillary features to modify the Aesthetic Scale (AC) of the IOTN

The modified IOTN was compiled into an album of fourteen photographs randomly spread, not in the order of attractiveness (Appendix 2).

The researcher was the only one that examined the subjects and rated their anterior teeth; and compared this with children's rating of their own teeth (Appendix 2).

EXAMINATION

This was done in natural light using disposable spatulas, to examine the subjects' occlusion, appearance of anterior teeth and any other dental problem that could may need the attention of a dentist.

DENTAL REPORT

Following the examination of the mouth, the state of the dental health was also recorded by the researcher on a sheet of paper and every child took home a report stating whether there was need for further dental consultation (Appendix 3).

PILOT STUDY

The Pilot study was undertaken at the University of the Western Cape to accomplish the following:
1. To test the feasibility of the research method.
2. To calibrate the researcher.
3. To determine the inter- and intra-examiner variability.

RESEARCH METHOD

Twenty children were chosen at random from the daily sifting register at the orthodontic clinic of the University of the Western Cape, in the month

of November, 2003. The subject selection was based on the inclusion criteria previously outlined.

The parents and guardians accompanying the children were approached and requested to permit their children participate in the survey. The purpose of the study was explained to them and a written consent sought (Appendix 3). The subjects were interviewed in the clinic to obtain independent responses to the questionnaire and later the photographs. Responses to the questionnaire were captured on the forms and scores of the Visual Analog Scale (VAS) were recorded using a ruler calibrated from zero to one where zero is the most negative response and one, the most positive (Appendix 1).

The subjects being interviewed were shown these colour AC photographs and asked the following question: "Identify which colour photograph most closely matched the appearance of your front teeth?". This was carried out from memory and no self-examination or conferring was allowed.

Upon examination it was emphasized that a general aesthetic impression is being sought, not an exact match with one of the photographs. At the same time the examiner rated the child's occlusion using the AC scale.

CALIBRATION AND STANDARDISATION

Using the colour photographs; the subjects, researcher and an experienced consultant orthodontist (Gold Standard) scored the appearance of anterior teeth. Then the researcher repeated the procedure on the same subjects after one or two weeks, being blinded from the previous scores (Appendix 4).

THE DETERMINATION OF THE INTER AND INTRA- EXAMINER VARIABILITY

From the ratings of the photographs by the subjects, researcher and the gold standard, calculation of the intra-examiner and inter-examiner was done (Appendix 5).

The photographs were grouped in 3 categories of treatment need. Agreement analyses using Kappa statistics were done (Freeman, 1987). An excellent agreement between the researcher's choice and gold standard with a Kappa value of 0.87 with a confidence level of (0.69; 1.04) was found. After one or two weeks the researcher undertook a second trial of choosing the photos against the gold standard and a perfect agreement, kappa value of 1 was found.

MEASUREMENT AND DATA COLLECTION

DATA COLLECTION

This study was undertaken during the period of January to February 2004. The schools were identified according to the sampling criteria and a visit to the school was made by the investigators. The principal of the selected school was approached for permission to undertake the study, and the letter from Education department granting permission for the study to be carried out was presented. The principal set an appropriate date for the study and consent forms were given out to the children to take home. The children returned the consent forms to the teacher before the scheduled days of the study.

During the scheduled days, the researcher's team visited the schools on the appointment time and the teacher introduced them to the children. Each participant whose parent and guardian had responded positively was

identified and they were moved to a different classroom where the study was undertaken. Of the six hundred consent forms sent to parents and guardians, four hundred and eighty eight (488) consented and met the inclusion criteria. The teacher then introduced the team to the children and informed them that after survey they would take home a report showing if there was any need for a dental consultation. The children were interviewed individually with assistants supervising the responses to the questionnaire and the researcher conducting the intra-oral examination and rating the appearance of the front teeth.

STRUCTURED QUESTIONNAIRE AND VAS

The questionnaire had two sections, the first concerned demographics and subjective perceptions of their dental appearance. The children were interviewed to capture their independent responses to the questionnaire. The second involved depicting these responses to the questions on a visual analog scale. On the continuum of zero to one in the VAS, the children marked where they perceived their responses to the question would fall. The assistants then recorded this mark using a ruler to capture the VAS readings (Appendix 1).

PHOTOGRAPHS

In the same sitting, the children selected a colour photograph of the AC that closely resembled the appearance of their anterior teeth. At the same time the researcher examined the children in natural light using wooden spatulas and rated the appearance of the anterior teeth against the same AC photographs (Appendix 2).

The children were given the following instruction: "I*dentify which colour photograph most closely matched the appearance of your front teeth?"*

At examination it was emphasized that a general aesthetic impression was being sought, not an exact match with one of the photographs. A report was issued following examination taking into consideration oral hygiene status and any dental pathological finding (Appendix 3). Data collected was recorded in the questionnaires and later were transferred to the Statistical Package of Social Sciences, SPSS (SPSS version 12.0.1) and Statistical Analysis Systems (SAS).

DATA ANALYSIS

CATEGORIZATION OF PHOTOGRAPHS ACCORDING TO TREATMENT NEED

The standard AC photographs of the IOTN and the above modifications were grouped to reflect the treatment needs, and for the purpose of this study, the moderate and great need was grouped in the 'treatment need' category (Table 1). This was necessary as there were too few subjects who responded with 'moderate need'.

Table 1: Categorization of the Photographs as per treatment Need

Category	Treatment Need	Photographs
1	Little or No Need	1,6,7,11,14
2	Need	2,3,4,5,8,9, 10,12, 13

VAS CATEGORISATION

The visual analog scale was divided into 4 segments which represented to the four responses in the questionnaire so that comparisons between the two could be made. Categorisation for questions 1 and 3 were done as follows:

1. Very dissatisfied: 0.0 to 0.25
2. Dissatisfied: 0.26 to 0.50.
3. Satisfied: 0.51-0.75
4. Very satisfied: 0.76-1.0.

For question 2 the categories were:

1. Worse   0.0 to 0.25
2. Similar   0.26 to 0.50
3. Better   0.51 to 1.00

STATISTICAL ANALYSIS

Standard descriptive statistics were generated and the data checked for normality. Frequencies were done as part of data cleaning and for ease of cross-tabulations as well as the determination of means for various variables.

Frequency distributions, by gender, to the questionnaire were calculated. Likewise, so were the mean visual analog readings for each question.

The Spearman's correlation was used for comparison of the VDS responses and VAS scores to questions 1 to 3.
A Chi-square test was done to assess any group or gender differences. It was also used to determine the correlation between the VAS-Categorised and the VDS responses.

The agreement analysis using Kappa statistics were used to determine the correlation between the researcher's and child's choice of photographs (Appendix 5).

LEGAL AND ETHICAL CONSIDERATIONS

Written consent by parent and guardian was mandatory for each subject participating in the survey which had to be produced prior to their participation (Appendix 4). The participants took home a report indicating the state of their oral health and any need for referral for dental treatment (Appendix 6).

The proposal to conduct this survey was approved by the Research Committees of the University of the Western Cape, the authorities of the Education department, Nairobi City Council, and the Research and Ethical Committees of the Kenyatta National Hospital in Nairobi, Kenya.

CHAPTER FIVE:
RESULTS

INTRODUCTION

The results are presented with respect to the following:

1. Description of the 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 Verbal Descriptor Scale (VDS) responses to the Aesthetic Components choices by both the respondents and researcher.

DEMOGRAPHIC FEATURES

There were 488 respondents, from a total of 600 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 249 female and 239 male respondents representing 51.0% and 49.0% of the sample respectively. The 11 year-olds comprised of 266 (54.5%) and 12 year-olds 222 (45.5%) of the sample. The mean age was 11 years 5 months with a standard deviation of 6 months, and the median was 11 years.

FREQUENCY DISTRIBUTION AND COMPARISONS OF RESPONSES TO THE QUESTIONNAIRE

QUESTION 1

'How satisfied are you with the appearance of your teeth?'

Table 2: Frequency of Responses by Gender

VDS	Male N (%)	Female N (%)	Total N (%)
Very satisfied	99 (41.4)	89 (35.7)	188 (38.5)
Satisfied	44 (18.4)	83 (33.3)	127 (26.0)
Dissatisfied	50 (21.0)	50 (20.0)	100 (20.5)
Very dissatisfied	46 (19.2)	27 (11.0)	73 (15.0)
Total	239	249	488

Chi-square =17.256; DF= 3; p=0.001

Frequency of responses

A total of 64.5% of the respondents were very satisfied and satisfied with the appearance of their teeth; only 15% were very dissatisfied (Table 2). Of the female respondents, 35.7% were very satisfied and 33.3% were

satisfied. Of the males, 41.4% were very satisfied and 18.4% were satisfied. With regard to the very dissatisfied group, 19.2% were male and 11.0% female respondents.

The gender difference was statistically significant with a p-value of 0.001 indicating that the females expressed more satisfaction with their appearance than did the males (Table 2).

Visual Analogue Scale (VAS)

The mean VAS score was 0.62 with a standard deviation of 0.31. On average, the respondents were satisfied with their dental appearance.

Comparison of frequencies of VDS and VAS-C

Table 3: Responses by VDS and VAS- C

		VAS-C - N (%)				
		Very satisfied	Satisfied	Dissatisfied	Very dissatisfied	Total
VDS - N (%)	Very satisfied	147 (78.2)	20 (10.6)	17 (19.0)	4 (2.1)	188
	Satisfied	35 (27.6)	44 (34.6)	43 (33.9)	5 (3.9)	127
	Dissatisfied	15 (15.0)	16 (16.0)	37 (37.0)	32 (32.0)	100
	Very dissatisfied	2 (2.7)	4 (5.5)	26 (35.6)	41 (56.2)	73
	Total	199	84	123	82	488

Chi-square test=294.816; DF=9; p<0.001.

Overall 269 (55.1%) participants chose similar VAS-C and VDS categories. Of the respondents who, on the VDS, answered that they were very satisfied, 78.2% also indicated so on the VAS-C. At the other extreme, 56.2% of the respondents chose very dissatisfied on VDS and

did likewise on the VAS-C. Interestingly 15.0% of the dissatisfied respondents on VDS placed themselves in very satisfied VAS-C. Similarly, 19.0% answered to being very satisfied on VDS but chose the dissatisfied VAS-C (Table 3).

Statistical analysis of responses yielded a p-value less than 0.001 (Table 2). Although the scoring for the VDS and VAS-C were similar in 55.1% instances there was a statistically significant difference in the rest of the groups choices.

Spearman's correlation between VDS and VAS

There was a high correlation coefficient value of 0.7 for VDS and VAS. The Spearman's correlation coefficient for VDS and VAS value was 0.680. The p-value was less than 0.001. This indicates that VDS and VAS-C responses were significantly correlated on the two scales of response to this question.

QUESTION 1A:

'If not satisfied with appearance of your teeth, why?'

Table 4: Responses to dissatisfaction

	Frequency	Percent
Colour	106	61.6
Arrangement	116	67.4
Size	103	59.9
Others	51	29.7

The 173 participants who indicated that they were dissatisfied or very dissatisfied with their appearance, 172 responded to the second part of question 1 representing 35.2% of the total sample of 488. Of these, 67.4% expressed dissatisfaction due to the arrangement of their teeth. Colour and size yielded a similar number of responses (Table 4).

Table 5 :Other reasons for dissatisfaction with
appearance of teeth

Reason	Total	Cumulative
Cavities	14	14
Bleeding	11	25
Weak	2	27
Broken	3	30
Pain	2	32
Nothing	2	34

There were thirty (30) representing 6.1% of the sample, who identified dissatisfaction with the appearance of their teeth due to reasons other than those outlined in question 1a (Table 5).

QUESTION 2

'How is the appearance of your teeth compared to the teeth of your friends?'

Table 6: Responses by Gender

VDS	Male N (%)	Female N (%)	Total N (%)
Better	125 (52.3)	130 (52.2)	255 (52.3)
Similar	53 (22.2)	65 (26.1)	118 (24.2)
Worse	61 (25.5)	54 (21.7)	115 (23.6)
Total	239	249	488

Chi-square test=1.54; DF=2; p=0.463

Frequency of responses

Overall 52.2% of the sample rated their teeth as better when compared with their peers (Table 6).

Statistical analysis by gender yielded no significant difference with a p-value of 0.463. This indicates that there was no gender difference in response to this question.

Visual Analogue Scale

The mean value for the VAS was 0.58 with a standard deviation of 0.30. On average, the respondents rated their teeth as better than those of their peers.

Comparison of Frequencies of VDS and VAS-C

Table 7: Responses by VDS and VAS-C

		VAS-C – N (%)			
		Better	Similar	Worse	Total
VDS - N (%)	Better	177 (69.4)	52 (20.4)	26 (10.2)	255
	Similar	65 (55.1)	41 (34.7)	12 (10.2)	118
	Worse	8 (7.0)	52 (45.2)	55 (47.8)	115
	Total	250	145	93	488

Chi-square test=143.905; DF=4; p <0.001.

The overall number of participants with the same response to the VDS and VAS-C totaled 273 (55.9%). Of the respondents who responded with better rating of their teeth than their peers, 69.4% were also found to have responded similarly in the VAS-C. Similarly, 47.8% of the respondents who chose worse in the VDS marked the same in the VAS-C. However, 45.2% who rated themselves as 'worse' in the VDS chose 'similar' on the VAS-C.

The statistical comparison of VDS and VAS-C responses yielded a result that was significant with a p-value of less than 0.001 (Table 7). This indicates the responses were significantly different on the two scales.

Spearman's correlation between VDS and VAS

There was a moderate coefficient of correlation of 0.54 observed between the corresponding VDS and VAS responses. The correlation coefficient between the scale and the VAS-C was 0.53. The p-value was less than 0.001. This means that there was a significant correlation in responses on the two scales.

QUESTION 3

'How satisfied are you with the way your teeth come together?'

Table 8: Responses to Q3 by gender

VDS	Male N (%)	Female N (%)	Total N (%)
Very satisfied	107 (44.8)	113 (45.4)	220 (45.1)
Satisfied	68 (28.5)	73 (29.3)	141 (28.9)
Dissatisfied	42 (17.5)	38 (15.3)	80 (16.4)
Very dissatisfied	22 (9.2)	25 (10.0)	47 (9.6)
Total	239	249	488

Chi-square test =0.528; DF = 3; p=0.913

Frequency of responses

There were 74.0% of the respondents that were satisfied or very satisfied with their occlusion. Gender analysis was not statistically significant with a p-value of 0.913 (Table 8). This implies no gender difference in response to this question.

Visual Analogue Scale

The mean score of VAS was 0.64 with a standard deviation of 0.30. On average, the respondents were satisfied with their occlusion.

Comparison of Frequencies of VDS and VAS-C

A total of 274 participants (56.1%) scored in the same categories on both scales. Of the very satisfied response group on the VDS, 77.3% also indicated very satisfied on the VAS-C. On the other hand, 56.5% of the very dissatisfied respondents on VDS were also very dissatisfied on the VAS-C. There were 36.9% of the respondents who responded satisfied in the VDS but responded dissatisfied on the VAS-C.

Table 9: Responses by VDS and VAS- C

		VAS-C - N (%)				
		Very satisfied	Satisfied	Dissatisfied	Very dissatisfied	Total
VDS - N (%)	Very satisfied	170 (77.3)	29 (13.2)	17 (7.7)	4 (1.8)	220
	Satisfied	37 (26.2)	40 (28.4)	52 (36.9)	13 (8.5)	141
	Dissatisfied	8 (10.0)	7 (8.8)	38 (47.5)	27 (33.8)	80
	Very dissatisfied	3 (6.5)	5 (8.7)	13 (28.3)	26 (56.5)	47
	Total	218	80	120	70	488

Chi-square test=275.649; DF=9; p<0.001

Statistical analysis between the VDS and the VAS-C yielded a p-value of less than 0.001. This indicated that the responses were significantly different on the two scales (Table 9).

Spearman's Correlation between VDS and VAS

There was a Spearman's correlation value of 0.7 observed between the VDS and the VAS responses. The coefficient of correlation between the VDS and the VAS-C responses was 0.67. The p-value was less than 0.001.

This implies that the responses on both VDS and VAS-C were significantly correlated.

TREATMENT NEED ACCORDING TO THE IOTN PHOTOGRAPHS

The AC photographs were categorized according to treatment need (Appendix 2).

Table 10: Treatment need by respondents and researcher

		Respondents		
		No Need	Need	Total
Researcher	No need	277 (89.1)	34 (10.9)	311 (63.7)
	Need	60 (33.9)	117 (66.1)	177 (36.3)
	Total	337 (69.1)	151 (30.9)	488

Kappa value = 0.57.

Respondents who chose photographs, which indicated 'no need for treatment', totaled 69.1%, whereas the researcher determined 'no need' in 63.7% of the respondents. For the 'treatment need' category, 30.9% subject's perceived need for treatment compared to 36.3% by the researcher. Of the respondents determined by the researcher to 'need treatment', 33.9% felt 'no need' for treatment. Statistically, there was a moderate agreement between the researcher's determination and perception of treatment need by respondents with a Kappa value of 0.57 (Table 10).

Analysis of the comparisons of perceived need for treatment by the male and female respondents against the researcher's determined need yielded a moderate agreement of Kappa value of 0.56 for female and 0.58 for male respondents.

COMPARISONS OF THE RESPONSES

COMPARISON OF RESPONSES TO QUESTION 1 AND QUESTION 3

Q1 - 'How satisfied are you with the appearance of your teeth?'

Q3 - 'How satisfied are you with the way your teeth come together?'

Table 11: Comparison of responses to Q1 and Q3

		Question 3 - N (%)				
		Very satisfied	Satisfied	Dissatisfied	Very dissatisfied	Total
Question 1 - N (%)	Very satisfied	129 (68.6)	39 (20.7)	10 (5.3)	10 (5.3)	188
	Satisfied	48 (37.8)	49 (38.6)	22 (17.3)	8 (6.3)	117
	Dissatisfied	29 (29.0)	30 (30.0)	32 (32.0)	9 (9.0)	100
	Very dissatisfied	14 (19.2)	23 (31.5)	16 (21.9)	20 (27.4)	73
	Total	220	141	80	47	488

Chi-square test= 109.265; DF=9; p<0.001

The number of respondents whose responses were the same through the categories totaled 252. Of those who were very satisfied with the appearance of their teeth, 68.6% were very satisfied with their occlusion as well. Those who were very dissatisfied with appearance, 27.4% were also very dissatisfied with their occlusion.

The agreement in responses to the two questions on appearance and occlusion was statistically significant with p-value of less than 0.001 (Table 11). This implies that they responded significantly differently to appearance and occlusion.

COMPARISON OF DISSATISFACTION WITH ARRANGEMENT AND OCCLUSION

Table 12: Comparison of Q1 and Q3

	Occlusion N(%)
Very Satisfied	22 (19.0)
Satisfied	36 (31.0)
Dissatisfied	37 (31.9)
Very Dissatisfied	21 (18.1)
Total	116

Of those who identified arrangement as a reason for being dissatisfied or very dissatisfied with their appearance (Q1), 19% and 31% were very satisfied or satisfied respectively with the way their teeth come together.

RANKING OF THE PHOTOGRAPHS AND TREATMENT NEED

The modified AC photographs of the IOTN were ranked, from "best" to "worst" to facilitate comparison of responses (Table 13).

The photographs were ranked in line with those of the standard IOTN, but with modification for the purposes of this study. Photograph 1 was ranked the most attractive and photograph 13, ranked least attractive. The treatment categorisation for each photograph is also indicated (Table 13).

Table 13: Ranking of Photographs and Treatment Need

Photograph	Rank	Respondent N(%)	Researcher N(%)	Treatment Need
1	1	38 (7.8)	22 (4.5)	No
7	2	107 (21.9)	126 (25.8)	
14	3	48 (9.8)	25 (5.1)	
6	4	133 (27.3)	128 (26.2)	
11	5	11 (2.3)	10 (2.0)	Moderate
5	6	64 (13.1)	90 (18.4)	
8	7	6 (1.2)	4 (0.8)	
10	8	5 (1.0)	2 (0.4)	
12	9	5 (1.0)	5 (1.0)	Great
9	10	29 (5.9)	28 (5.7)	
2	11	25 (5.1)	29 (5.9)	
4	12	7 (1.4)	12 (2.5)	
3	13	2 (0.4)	1 (0.2)	
13	14	8 (1.6)	6 (1.2)	

COMPARISON OF THE PHOTOGRAPHS CHOSEN BY THE RESPONDENTS AND RESEARCHER

There was a general similarity in selection of photographs by the respondents' and the researcher. The three most chosen photographs by respondents and researcher were photographs numbers 7, 6 and 5; ranked numbers 2, 4, and 6 respectively. Conversely, the photographs least selected by both were numbers 3, 10, 12, and 8; which were ranked numbers 13, 8, 9, and 7 respectively (Graph 1).

COMPARISON OF RANKED PHOTOGRAPHS AND QUESTION 1A (ARRANGEMENT)

Of the respondents who answered dissatisfied with the appearance of their teeth due to arrangement; 20.7% chose photograph ranked number two,

28.4% chose photograph ranked number four, while 10.3% selected photograph ranked number six. They did not generally choose the highly ('worst') ranked photographs.

Of the respondents who were dissatisfied with appearance of their teeth due to arrangement, the researcher chose photograph ranked number two in 18.1%, and photograph ranked number four in 31.9% of the cases. Similarly, the researcher chose photograph ranked number six in 15.5% of the cases. About 3.0% of the highly ('worst') ranked photographs were selected (Table 14).

Table 14: Comparison of Ranked Photographs
with Question 1a

	Rank	Respondent N(%)	Researcher N(%)
Photographs	1	4 (3.4)	2 (1.7)
	2	24 (20.7)	21 (18.1)
	3	9 (7.8)	6 (5.2)
	4	33 (28.4)	37 (31.9)
	5	3 (2.6)	2 (1.7)
	6	15 (12.9)	18 (15.5)
	7	2 (1.7)	
	8	2 (1.7)	
	9	1 (0.9)	2 (1.7)
	10	7 (6.0)	8 (6.9)
	11	12 (10.3)	17 (14.7)
	12	2 (1.7)	2 (1.7)
	13	1 (0.9)	1 (0.9)
	14	1 (0.9)	
	Total	116	161

COMPARISON OF RANKED PHOTOGRAPHS AND Q3 (RESPONDENTS)

The respondents who were very satisfied with their occlusion chose photographs of low ('best') ranking. Their choices were as follows: 10.5% chose photograph ranked number one, 16.8% chose photograph ranked number two, 10.0% chose photograph ranked number three and 29.5% chose photograph ranked number four. Only 5.9% chose photograph ranked number eleven. The very dissatisfied group with their occlusion, 21.3% chose photograph rank number two, 21.3% chose photograph ranked number four, and 12.8% chose photograph ranked number six. The chi-square test was significant with a p-value of 0.005 (Appendix 7). There was a difference in respondents' selection of photographs and satisfaction with occlusion.

COMPARISON OF RANKED PHOTOGRAPHS AND Q3 (RESEARCHER)

Of those who answered very satisfied with their occlusion, 25.9% of the respondents were determined by the researcher to match with photograph ranked number two, 25.5% with photograph ranked number four, and 2.7% with photograph ranked number twelve. The very dissatisfied group, 19.1% selected photograph ranked number two, 25.5% photograph ranked number four and 19.1% with photograph ranked number six. The chi-square test was not significant with a p-value of 0.223 (Appendix 8). There was no difference between researcher's selection of photographs and respondents satisfaction with occlusion.

COMPARISON OF RANKED PHOTOGRAPH BY CHILD AND RESEARCHER

Of the photographs chosen by the researcher ranked number one, 72.7% agreed with those chosen by the respondents. Similarly, of those chosen by the researcher ranked numbers six and seven, 63.3% and 43.7% respectively agreed with the respondents (Appendix 9).

COMPARISON OF ARRANGEMENT RESPONSE AND SELECTED PHOTOGRAPH

Table 15: Arrangement response and treatment need photographs

Response	Respondents N(%)	Researcher N(%)
No need	73 (62.9)	68 (58.6)
Treatment need	43 (37.1)	48 (41.4)
Total	116	116

There were 62.9% of the total respondents who were dissatisfied with arrangement and chose no need for treatment photographs. The researcher determined that 58.6% of the same respondents needed no treatment. The respondents and researcher recorded that 37.1% and 41.4% needed treatment respectively.

CHAPTER SIX:
DISCUSSION

INTRODUCTION

This survey, done on school children from public schools in Nairobi, hopefully would begin to raise the level of awareness of perceptions of occlusal conditions in both the relevant authorities and the general public.

DEMOGRAPHIC FEATURES

The participants were drawn from communities of a low to middle socio-economic background. A total of 112 children were excluded for various reasons including having received or presently undergoing orthodontic treatment. The number of those who did not meet the inclusion criteria because of age and lack of consent were in the majority. Those who had been excluded because of orthodontic treatment were numerically insignificant; one was undergoing fixed appliance therapy and 27 had previous treatment, mainly removable appliances. This may not be an accurate assessment of treatment status at these schools as children who did not fulfill the inclusion criteria were not asked to obtain consent.

It would be difficult to compare this Kenyan sample with studies done elsewhere such as, the 26 percent found in the United Kingdom (Tulloch et al., 1984; Gravely, 1990) and 47 percent in the United States of America (Tulloch et al., 1984). These treatment levels are ascribed to a number of factors such as the socio-economic background of the respondents, the availability of an orthodontic service, the level of awareness, need and demand for orthodontic treatment, and the social acceptability of occlusal and facial disharmony in these communities; are variables that have been shown to affect the demand for orthodontic treatment (Shaw, 1981).

SATISFACTION WITH DENTAL APPEARANCE

Studies have shown that most teenagers have developed an oral perceptual awareness (Shaw et al., 1975 and 1980; Lindsay and Hodgkins, 1983; Tulloch et al., 1984; Roberts et al., 1989). Furthermore, adolescent children have been shown to be more critical of their own dental appearance as there is a meaningful association between treatment need and concern expressed by the 11 year-olds (Reidmann et al., 1999). Studies conducted in young adults have reported that they are also aware of their anterior occlusal traits and this is particularly so in those who seek orthodontic treatment (Espeland and Stenvik, 1991a; Fox et al., 2000).

In this study satisfaction with appearance of teeth was assessed using a verbal descriptor scale (VDS) questionnaire and a visual analogue scale (VAS). The participants expressed a general satisfaction with their dental appearance, of which approximately 65% were satisfied while only 15% were very dissatisfied (Table 2).

Studies on awareness of dental appearance have reported that children with a lesser perceptual awareness tended to be more dissatisfied with their dental appearance and perceived a greater need for orthodontic treatment (Shaw, 1981). In contrast to this, a study comparing school children in the United Kingdom and United States of America, it was shown that perceptions of dental attractiveness and treatment need were similar. However, other subtle differences were found, with the American having a more realistic perception of treatment time, probably attributable to their greater exposure to peers undergoing orthodontic treatment (Tulloch et al., 1984).

With regard to responses to satisfaction by gender, it was found that almost 70% of females and 60% of males were satisfied with their dental

appearance. Of those who expressed dissatisfaction, 19.2% were male and 11.0% female respondents.

This is in contrast to earlier gender studies on perceptions that have shown that girls are more concerned than boys in their self-evaluations (Shaw, 1981 and Holmes, 1992b), and have shown that females are more dissatisfied with appearance of teeth than males (Shaw, 1981; Sheats et al., 1998). The gender difference was found to be statistically significant suggesting that females were more satisfied with the appearance of their teeth than the males. This is supported by reports by Tung and Kiyak (1998) that with increasing significance of peer acceptance for adolescents, girls in particular express greater concern about their facial features, especially when they are different from those of peers.

DISSATISFACTION WITH DENTAL APPEARANCE

'Dissatisfaction with dental appearance' was found in 35% of the participants. Of these, dissatisfaction due to the arrangement accounted for 67.4% of the responses while the contribution by other factors was almost equal (Table 4). Studies have shown that the motivation to seek orthodontic treatment appears to be strongly related to individual's perceptions of the extent to which their dento-facial appearance deviates from socio-cultural norms (Stricker, 1970; Jenny, 1975; Gochman; 1975). Studies that have evaluated the self-perception of dental characteristics indicate that the general public is generally aware of dento-facial abnormalities, particularly excessive overjet (Dongieux and Sassouni, 1980). In this study, arrangement of teeth was assumed to be representative of dental characteristics of orthodontic concern.

Reports have indicated that with increased severity of malocclusion, there is an increasing level of self-recognition (Howitt et al., 1967). Dissatisfaction with dental appearance is broadly related to the severity of

the occlusal irregularities but there may be differences in its recognition and evaluation (Albino et al., 1981). Gosney (1986) in his investigation of the factors that influence the desire for orthodontic treatment found that the presence of spacing, crowding, or rotation perturbed girls more than boys. Gochman (1975) found that school children in the middle grades preferred a dentition that is normally occluded, despite it being spaced and also severely affected by caries to one that is maloccluded, but healthy.

The reason for dissatisfaction with one's dental appearance in this study cannot, however, be directly compared with previous studies is 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). Dissatisfaction with one's anterior teeth could be multi-factorial with those of lesser importance not being given attention.

PEER COMPARISON OF OCCLUSION

A number of studies have underlined the importance of satisfactory childhood peer relations for successful emotional and social development (Hartup, 1978). Rejection by one's peers is perhaps one of the greatest catastrophes that can befall an adolescent (Mery and Mery, 1958). The implications of a facial appearance which evokes unfavourable social judgments may, therefore, be of considerable significance.

The relationship between perception and influence of peers was investigated and it was found that over half the respondents rated their teeth as being better than their peers. About one-quarter said their teeth were 'worse'. No gender difference was found (Table 6).

In the literature the importance that facial attractiveness plays in social acceptance by peers is emphasized. A positive relationship exists between

facial attractiveness and popularity; which informs the favourable evaluation of one's personality, social behaviour and intellectual expression by others (Albino and Lawrence, 1994). This substantiates the claims that peer-influence plays a major role in determining orthodontic treatment compared with social class or gender (Tulloch et al., 1984: Burden and Pine, 1995). Therefore professional knowledge about orthodontic perceptions in different age groups may also be useful (Stenvik et al., 1997).

SATISFACTION WITH OCCLUSION

The perception of occlusion was also investigated in this study, and it was found that three-quarters of the children were satisfied with their occlusion. Satisfaction of occlusion by gender was analysed and no difference was elicited (Table 8).

The perception of occlusion is complex to analyse since studies have shown that it is influenced by many factors such a societal aesthetic norms, psychological factors and personal norms of dental attractiveness (Espeland et al., 1991a). It has been shown that deviant traits accepted in other persons may not be tolerated in oneself. To some extent, studies have shown that satisfaction with personal dental appearance is related to the actual occlusal status (Howitt et al., 1967; Shaw, 1981; Helm et al., 1985 and 1986; Horup et al., 1987). It has been demonstrated that, in childhood populations, even normally positioned teeth have been inaccurately perceived as being malaligned (Horowitz et al., 1971; Shaw, 1981).

TREATMENT NEED AND DEMAND

INTRODUCTION

In the literature terms such as subjective treatment need, self-perceived need and demand for treatment have been used interchangeably. Likewise so have objective treatment need, normative treatment need, professionally determined need and treatment need.

NEED AND DEMAND

The results from this study suggest an association between demand and treatment need, as evaluated by the AC component of the IOTN (Table 10). The relationship between the researcher's assessment, on the AC, and self- perception of the child was clear. Almost 70% of the respondents chose photographs, which indicated 'no need for treatment', and approximately 31% chose those that indicated otherwise. The researcher determined 'no need' in 64% and need in 36% of the respondents. Of the respondents, found by researcher to have 'need for treatment', 34% indicated no need.

This contradiction could be due to a number of reasons. Firstly, the children may not have developed an adequate oral perception or may have under-estimated their perception, due to differences in recognition and evaluation (Albino et al., 1981). Secondly, it could be that the researcher was more critical in the operation of the scales, as has been shown in the previous studies (Shaw et al., 1975; Prahl-Andersen, 1978). The other reason could be that the participants may not have comprehended the questions or the scales of responses.

These findings confirm the statement by Kunzel (1987) that orthodontic treatment appears to be an area where objective and subjective need for

treatment is not identical. Self-perception of the dento-facial complex and the psychosocial need are relevant to consumers of orthodontic care, and treatment can often be more influenced by demand than by need (Gosney, 1986; Shaw et al., 1991a; Sheats et al., 1998).

Gender and treatment Need and Demand

The Kappa values indicated that there was a moderate agreement in 'treatment need" in both males and females concurring with previous studies (Tang and So, 1995; Kerusuo et al., 2000; Izabela, 2003). There are, however, numerous studies that have reported higher treatment needs for males than for females (Holmes, 1992; Burden et al., 1994); in contrast higher needs for females than for males have been suggested (Holmes, 1992b; Tuominen et al., 1994). It has been reported that the demand for treatment is greatest in females, among whites, in urban populations and among children of higher socioeconomic status (Soh and Lew, 1986; Holmes, 1992b; Wheeler et al., 1994). Paradoxically, the need for treatment was found to be greater for males, and whites, equal across socioeconomic strata and the same in urban and rural settings (Wheeler et al., 1994).

COMPARISON WITH OTHER STUDIES

According to the findings of this survey, 36.3% of Kenyan children had a need for treatment which compares favourably with that of Ng'ang'a and coworkers (1997) in which 29% were recorded, using the Norwegian Treatment Need Index (NTNI). In this study the demand for treatment was 30.9% using the AC but Ng'ang'a et al.(1997) using a structured questionnaire found 33% in the same population group. Other African studies have determined a lower need for treatment in children. A need for treatment was determined to be in 11% of Tanzanian children (Mugonzibwa et al., 2004), and using the IOTN, Otuyemi and colleagues (1997) reported 13% in Nigerian children.

These African studies, on treatment need, contrast significantly with those in Europe. The treatment need has been reported to be 2% for British and 5% for Turkish children (Brook and Shaw, 1989; Burden and Holmes, 1994; Ucuncu and Ertugay, 2001). However, there was a marked similarity in the report of treatment need among young adults in Finland, which was determined to be about 11% (Kerusuo et al., 2000).

The relationship between need and demand is of interest to providers of orthodontic services. This mismatch of need and desire for treatment is a problem for orthodontists (Tickle and Bearn, 2001). In general, treatment need has been reported to be higher than that expressed by the respondents themselves (Shaw et al., 1991; Tuominen et al., 1995; and Sheats et al., 1998). Less than 60% agreement between need and demand for treatment has even been reported (Tang and So, 1995). Also, irrespective of their higher number, respondents selected by "objective" treatment need indices have not included all with demand, and vice versa (Tang and So, 1995; Tuominen et al., 1995).

Although, despite using different occlusal indices, agreement in the assessment of orthodontic treatment need between professionals has been reported (Richmond and Daniels, 1998; Firestone et al., 2002) these evaluations do not necessarily reflect the treatment need expressed by the general public (Shaw et al., 1991a; Tuominen et al., 1994; Sheats et al., 1998). This observation is consistent with the suggestions that professionals run a more critical aesthetic scale on perception of dental attractiveness or treatment need than does the public or society in general (Shaw et al., 1975; Prahl-Andersen, 1978; Abdullah and Rock, 2002).

Although the IOTN had been designed for use with 11 to 12-year-old children (Brook and Shaw, 1989), the reliability in this age group has been questioned (Mandall et al., 2001). Nonetheless, investigators have found it to be useful when evaluating 15 to 16-year-olds (Burden and Pine, 1995;

Kerusuo et al., 2004). Kerusuo and others (2004) found a high correlation between treatment need as assessed by professionals and demand for orthodontic treatment among teenagers, when using the AC component of the IOTN.

COMPARISON OF APPEARANCE, DISSATISFACTION WITH ARRANGEMENT, AND OCCLUSION

About 70% of the respondents were both very satisfied with their appearance (question 1) and occlusion (question 3) as shown in Table 12. However, statistically, there was a significant difference in the responses to these two questions.

The children who indicated 'dissatisfaction with arrangement' (question 1a) responded in almost equal numbers to all four categories of question 3 (occlusion). Exactly 50% indicated 'satisfied' and 'very satisfied' with their occlusion (Table 12). These participants obviously did not associate arrangement of teeth with concept of occlusion. Therefore, the terms arrangement, occlusion and dental appearance may have been confusing to the participants.

RANKING OF THE PHOTOGRAPHS AND TREATMENT NEED

The photographs were ranked from 'best' to 'worst' (see Table 13). This approach of using the opinion of clinicians to verify treatment needs is not unique and was used by earlier workers to validate other occlusal indices (Salzmann, 1968; Summers, 1971; Jenny et al., 1983). The modification was done to include occlusal features that are prevalent amongst black people. The exclusion of these features has been viewed as a major shortcoming of the IOTN and includes anterior open bite, anterior diastema and reverse overjet (Lunn et al., 1993; Trottman et al., 1996).

The use of AC photographs for self-assessment has been deemed appropriate, as visual stimuli may be more useful than verbal descriptions in communicating with children (Howells and Shaw, 1985).

It could be argued that the use of professional opinion to validate an orthodontic aesthetic ranking scale is inherently flawed (Hunt et al., 2002). Numerous indices have confirmed that, by virtue of their training and experience, dental professionals are conditioned to take an overly critical view of any deviation from normal occlusion (Shaw et al., 1975; Prahl-Andersen, 1978). Many dentists favour an interventional approach even where this is not sought by the patient or parent, and may not necessarily be of significant benefit (Shaw et al., 1975; Prahl-Andersen, 1978; Downer, 1987). This may be further aggravated if the professionals' and patients are not from the same cultural background (Giddion, 1974).

COMPARISON OF RANKED PHOTOGRAPHS AND ARRANGEMENT

When comparison of ranked photographs selected and arrangement was done, it was found that respondents who answered 'dissatisfied with the appearance of their teeth due to arrangement' 60.3% chose photographs (ranked 1 to 4) that indicated no need for treatment. There appears to be a difference in their self-assessment and the visual interpretation of their occlusion (Table 14).

It has been stated that judgments involved in the perception of malocclusion are complex and are generally considered to be highly subjective (Stricker, 1970; Hershon and Giddon, 1980; Phillips et al., 1992). It has also been reported that some respondents under-estimate the severity of their irregularity (Goldstein, 1969; Myberg and Thilander, 1973) while others express dissatisfaction with objectively good occlusion (Howitt et al., 1967; Lewitt and Virolainen, 1968; Shaw, 1981).

Other studies have found that dissatisfaction with dental appearance was generally related to the severity of the occlusal irregularities (Shaw, 1981; Tedesco et al., 1983; Burden and Pine, 1995; Mandall et al., 1999).

COMPARISON OF OCCLUSION AND RANKED PHOTOGRAPHS BY RESPONDENTS AND RESEARCHER

When a comparison of 'satisfaction with occlusion' and the ranked photographs chosen by the respondents was done, it was found that two-thirds (66.8%) chose photographs of low ranking (1 to 4) indicating no need for treatment. Only about 6% of this satisfied group chose high ranked photograph number eleven. For those very dissatisfied with occlusion, about 40% chose photographs of low ranking indicative of no need of treatment. However, 12.8% chose photograph ranked number six of moderate need. This comparison yielded a statistically significant difference between satisfaction with occlusion and selection of ranked photographs (Appendix 7).

Comparison was also done of the selection of ranked photographs by the researcher, and the respondents 'satisfaction with occlusion'. It was found that over 50% of those who answered 'very satisfied with occlusion' chose photographs indicating no need for treatment. These photographs were however also chosen by about 45% of the 'very dissatisfied group' (Appendix 8).

There was a tendency for the children (irrespective of being satisfied or not) to select the low ranking photographs. These findings are supported by several studies that report a tendency, for both researcher and respondents, to select photographs toward the attractive (low) end of the scale (Holmes, 1992; Burden and Pine, 1995; Kerusuo et al., 2000; Kerusuo et al., 2004).

The respondents and the researcher, both, tended to over-score the moderate or borderline malocclusions. A similar tendency was also reported in other studies (Hunt et al., 2002; Izabela, 2003). They recommended that the threshold for the initiation of orthodontic treatment should be lowered so that grade 4 of the Aesthetic Component of the IOTN is included in the treatment need category. Similarly, Kerusuo and colleagues (2004) found that the moderate or borderline category is often associated with treatment demand.

COMPARISON OF RANKED PHOTOGRAPHS BY CHILDREN AND RESEARCHER

The comparison of the ranked photographs, selected by child and researcher, yielded a 58.2% overall agreement. The participants and researcher chose 66.8% (376) and 61,6% (301) photographs that indicated no need for treatment. At the other end of the scale the choices were children 15,6% (76) and researcher, 16.8% (82) for great need for treatment.

However, there was a statistically significant difference in the choices (Appendix 9).

Other studies have estimated that the publics' assessment of their own treatment need was relatively close to the opinions of dentists (Lindegard et al., 1971; Millen et al., 1986), although their criteria and preferences could be very different (Prahl-Andersen, 1978; Prahl-Andersen et al., 1979; Shaw, 1981).

COMPARISON OF ARRANGEMENT RESPONSE AND SELECTED PHOTOGRAPH

When a comparison of arrangement response (question 1a) and selected photographs was done, the results showed that 63% of the respondents dissatisfied with the arrangement of their teeth chose the 'no need for treatment' photographs. The researcher determined that 58.6% of the same respondents needed no treatment, however there was a 41.4% agreement on treatment need.

Generally, children consider severe deviations including crowding as unattractive. They preferred photographs of low ('best') ranking irrespective of whether the appearance of their teeth was closer to them or not. This contradictory finding is supported in the literature. It has been stated that while dissatisfaction with dental appearance is broadly related to the severity of the occlusal irregularities there are differences in its recognition and evaluation (Albino et al., 1981).

COMPARISON OF VERBAL DESCRIPTOR RESPONSE (VDS) AND VISUAL ANALOGUE (VAS)

The responses to the questionnaire were captured using the two methods: the Verbal Descriptor Scale (VDS) and Visual Analogue Scale (VAS). Both scales elicit subjective responses, which were compared to determine if any differences existed.

For all three questions there was some agreement at the extreme ends of the scale. However comparison between the two scales yielded a statistically significant difference.

The results show that the two scales are almost similar in scoring respondents at the extremes. Problems arise in the middle categories,

where fewer respondents agreed and therefore the responses were dispersed over this region.

It would appear that the children had difficulty in responding to the VAS. This may have been due to a lack of understanding of what was required of them. There may be a lack of sensitivity of the VAS to the "middle group".

The marginal reliabilities of these scales, when used by dentists to quantify the patient's pain, suggest that neither scale should be regarded as an objective pain measure (Le Resche et al., 1988). In fact in a study on perceptual evaluation of dysphonia, it was recommended that the original 4-point version of the VDS was better at evaluation than the VAS (Wuyts et al., 1999).

LIMITATIONS OF THE STUDY

1. Assessments of perception of malocclusion are complex and are generally considered to be highly subjective and like all other evaluations are qualitative and subjective, whether by clinicians' or patients' ratings, rankings, or categorisation.

2. The validity and reliability of the use of the modified or expanded photographs of the IOTN as an instrument might have been compromised because the researcher used only 14 photographs that are meant to reflect specific deviations or common malocclusions in children found in Kenya.

3. The designation of modified AC into treatment need categories was in itself 'subjective' and what clinicians' may consider aesthetic pleasing may be influenced by their training, which in turn may be substantially different to their patients' opinions (Scott and Johnston, 1999; Hall et al., 2000; Park et al., 2003).

4. The responses to peer comparison of appearance of teeth was erroneously categorised into four responses with 'very good' as an option of response. This had to be omitted in the analysis and its responses condensed with those of the 'better' response.

5. The use of Visual Analogue Scale (VAS) to capture subjective responses was difficult to comprehend by the children and required interpretation. Secondly, the VAS had to be categorised to enable comparison with responses to the questionnaires. This categorisation of the VAS in quarters to match the other responses is in itself untested.

CHAPTER SEVEN:
CONCLUSION

1. Two-thirds of the respondents were satisfied with the appearance of their teeth, with females being more satisfied than males.
2. More than 50% of the respondents perceived their teeth as being better than those of their peers.
3. Three-quarters of the respondents were satisfied with their occlusion.
4. There was a moderate agreement in perception of occlusal appearance between respondents and that determined by the researcher.
5. There was no gender difference in perception of treatment need.
6. The researcher determined a higher need for treatment than that perceived by the respondents.
7. The Aesthetic Component of the IOTN is a valid tool in aesthetic evaluation and assessing the self-perceived need for treatment.
8. The visual analog scale (VAS) as a tool of subjective assessment was found difficult to apply when compared to the traditional verbal descriptor scale (VDS).

RECOMMENDATIONS

1. The information on perception, gathered in this study, could be of importance in establishing baseline data for planning orthodontic services, human resource training needs, and continuing education for oral health personnel, public health programs, screening for treatment priority, and resource planning.

2. To be able to determine the overall need and demand for the Kenyan society, more studies involving children from different areas of the country, especially rural settings should be attempted.

3. The Aesthetic Component of the IOTN may need to be modified to create a greater sensitivity to local variation in occlusal traits.

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APPENDIX

APPENDIX 1

QUESTIONNAIRE FORM

THE PERCEPTION OF OCCLUSAL APPEARANCE IN 11- TO 12-YEAR-OLD CHILDREN IN NAIROBI, KENYA

PERSONAL DETAILS

Name and Surname	
Class	
Date of Birth	
Age	Years	Months

Which estate do you live in Nairobi	

How long have you lived in Nairobi	(yrs/months)

Assessment of occlusal appearance and awareness

1. How satisfied are you with the appearance of your teeth?

Very satisfied	
Satisfied	
Dissatisfied	
Very dissatisfied	

VAS: 0…………………………………………………………………1

If not satisfied, why? ....

Colour	
Arrangement	
Size	
Others (pain, decay, weak etc)	
Nothing	

2. How is the appearance of your teeth compared to the teeth of your friends?

Very good	
Better	
similar	
worse	

VAS: 0……………………………………………………………………………1

3. How satisfied are you with the way your teeth come together?

Very satisfied	
satisfied	
dissatisfied	
Very dissatisfied	

VAS: 0……………………………………………………………………………1

APPENDIX 3

STATEMENT OF DENTAL CARE

To; Dear Parent/ Guardian;

Thanks for allowing your child/ children participate in this survey.

Your child

Needs	
Does not need dental treatment	

Thanks once again for your co-operation.

Dr Nathan Psiwa

(Dept of Orthodontics, UWC)

APPENDIX 4

Evaluation of occlusal appearance using the modified AC scale of IOTN

Child No	Modified AC chosen by child	Modified AC chosen by Researcher's	Experienced Orthodontist's evaluation (Gold Standard)
1			
2…			

Evaluation of occlusal appearance using the modified AC scale of IOTN

Child No	Modified AC chosen by child	Modified AC chosen by Researcher's
1		
2…		

APPENDIX 5

SOME LITERATURE ON STATISTICAL CONCEPTS

AGREEMENT AND KAPPA COEFFICIENT:

Agreement is assessed in a set of data with N subjects, and two or more ratings per subjects, each rating an assignment to one of k categories. Generally a statistic that reflects some intuitive definition of agreement is proposed. This proposal involves:

1. Defining some measure of pair wise agreement giving each subject an agreement score equal to the pair wise agreement measure averaged over all pairs of ratings.

2. Averaging the agreement scores over subjects.

3. Assessing how the average agreement score relates to what one would define as ideal agreement in the dataset.

When the responses are measured on a categorical scale an obvious measure of agreement is the proportion of responses in agreement. Kappa is a coefficient of agreement for nominal scale data. Consider the agreement matrix of proportions arising from measurements on a nominal scale with k categories.

Table 16: Kappa Correlations

	Category	1	2	….	k	Total
	1	P11	P12		P1k	P1
Rater B	2	P21	P22		P2k	P2
	..					..
	k	Pk1	Pk2		Pkk	Pk
	Total	P1	P2		Pk	
	Ranges					

There are two quantities: $P_0 = \sum_{i=1}^{k} pii$ is the proportion of units in which there's

a perfect agreement, and $P_e = \sum_{i=1}^{k} pi.p.i$

is the proportion of units for which agreement is expected by chance. If there's agreement, P_o will exceed P_e and the difference P_o-P_e will be positive. This difference will be numerator of the coefficient. The maximum possible value of

P_o-P_e is 1-p_e which is the denominator of the coefficient. The coefficient K is simply the proportion of chance expected disagreement which does not occur, or it's the proportion of agreement after chance agreement is removed from consideration. K = (P_o-P_e) /1- P_e

PROPERTIES OF THE KAPPA STATISTIC

When the obtained agreement is equal to chance agreement, then K=0.The upper limit of K is +1.00,occurring at the perfect agreement in which case the marginals will necessarily be equal. If observed agreement is greater than, or equal to chance agreement, $K \geq 0$ and if observed agreement is less than or equal to chance agreement $K \leq 0$.

Table 17: Ranges indicating the degree of agreement

K	Strength of Agreement
0	Poor
0.01-0.20	Slight
0.21-0.40	Fair
0.41-0.60	Moderate
0.61-0.80	Substantial
0.81-1.00	Almost Perfect

 For most agreement purposes values greater than 0.75 or so may be taken to represent excellent agreement beyond chance while values below 0.40 or

so may be taken to represent poor agreement beyond chance and values between 0.40 and 0.75 may be taken to represent fair agreement beyond chance.

SPEARMAN'S CORRELATION COEFFICIENT:

Spearman's rank correlation coefficient is used to test a hypothesis of no association between populations. The rank Spearman's correlation coefficient is calculated by using the ranks as the paired measurements between the two variables. (Freeman, 1987).

APPENDIX 6

CONSENT FORM

Dear Parent/Guardian;

 The University of the Western Cape (RSA) is conducting a survey on the perception of Dental or occlusal Appearance by 11 to 12-year-old school children for proper planning of its services. The study involves responding to a questionnaire and the child will be required to rate the attractiveness of his or her front teeth. There will be no provision for any treatment, but the child/ children will bring home a short note stating any need of dental care. All the information gathered during the course of this research will be kept completely confidential.

 MY CHILD MAY PARTICIPATE IN THE SURVEY

YES	
NO	

 Kindly, allow the child to return this form to school.

Yours faithfully

Dr Nathan Psiwa
Department of Orthodontics (UWC)

APPENDIX 7

Comparison of Ranked Photograph (Child) and Question 3

		Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	Total
Photograph	1	23 (10.5)	7 (5.0)	8 (10.00)		38 (7.8)
	2	37 (16.8)	46 (32.6)	14 (17.50)	10 (21.3)	107 (21.9)
	3	22 (10.0)	14 (9.9)	9 (11.25)	3 (6.4)	48 (9.8)
	4	65 (29.5)	38 (27.0)	20 (25.00)	10 (21.3)	133 (27.3)
	5	4 (1.8)	2 (1.4)	3 (3.75)	2 (4.3)	11 (2.3)
	6	38 (17.3)	14 (9.9)	6 (7.50)	6 (12.8)	64 (13.1)
	7	3 (1.4)		3 (3.75)		6 (1.2)
	8	1 (0.5)	2 (1.4)		2 (4.3)	5 (1.0)
	9	2 (0.9)	2 (1.4)		1 (2.1)	5 (1.0)
	10	6 (2.7)	8 (5.7)	8 (10.00)	7 (14.9)	29 (5.9)
	11	13 (5.9)	3 (2.1)	6 (7.50)	3 (6.4)	25 (5.1)
	12	2 (0.9)	2 (1.4)	2 (2.50)	1 (2.1)	7 (1.4)
	13	1 (0.5)			1 (2.1)	2 (0.4)
	14	3 (1.4)	3 (2.1)	1 (1.25)	1 (2.1)	8 (1.6)
	Total	220	141	80	47	488

APPENDIX 8

Comparison of Ranked Photograph (Researcher) and Question 3

		Very Satisfied	Satisfied	Dissatisfied	Very Dissatisfied	Total
Photograph	1	14 (6.4)	5 (3.5)	3 (3.8)		22 (4.5)
	2	57 (25.9)	42 (29.8)	18 (22.5)	9 (19.1)	126 (25.8)
	3	10 (4.5)	8 (5.7)	4 (5.0)	3 (6.4)	25 (5.1)
	4	56 (25.5)	40 (28.4)	20 (25.0)	12 (25.5)	128 (26.2)
	5	5 (2.3)	3 (2.1)	2 (2.5)		10 (2.0)
	6	48 (21.8)	22 (15.6)	11 (13.8)	9 (19.1)	90 (18.4)
	7	2 (0.9)	1 (0.7)	1 (1.3)		4 (0.8)
	8		1 (0.7)	1 (1.3)		2 (0.4)
	9	1 (0.5)	3 (2.1)	1 (1.3)		5 (1.0)
	10	6 (2.7)	6 (4.3)	9 (11.3)	7 (14.9)	28 (5.7)
	11	13 (5.9)	5 (3.5)	7 (8.8)	4 (8.5)	29 (5.9)
	12	6 (2.7)	3 (2.1)	2 (2.5)	1 (2.1)	12 (2.5)
	13				1 (2.1)	1 (0.2)
	14	2 (0.9)	2 (1.4)	1 (1.3)	1 (2.1)	6 (1.2)
	Total	220	141	80	47	488

APPENDIX 10: Comparison of Ranked Photographs

	AC - Researcher														
Photo-graph	1	2	3	4	5	6	7	8	9	1	11	12	13	14	Total
1	16 (72.7)					5 (3.9)	15 (11.9)							2 (8.0)	38 (7.8)
2	1 (4.5)	2 (6.9)			2 (2.2)	2 (1.6)									25 (5.1)
3			1 (100.0)		1 (1.1)										2 (0.4)
4				4 (33.3)		3 (2.3)									7 (1.4)
5					49 (54.4)	6 (4.7)	8 (6.3)				1 (10.0)				64 (13.1)
6	1 (4.5)	7 (24.1)		3 (25.0)	8 (8.9)	81 (63.3)	26 (20.6)	2 (50.0)	2 (7.1)		3 (30.0)				133 (27.3)
7	2 (9.1)			2 (16.7)	15 (16.7)	25 (19.5)	55 (43.7)	1 (25.0)	1 (3.6)			1 (20.0)		5 (20.0)	107 (21.9)
8				2 (16.7)		1 (0.8)	2 (1.6)							1 (4.0)	6 (1.2)
9	1 (4.5)					1 (0.8)	2 (1.6)		25 (89.3)						29 (5.9)
10		1 (3.4)		1 (8.3)		2 (1.6)				1 (50.0)					5 (1.0)
11					5 (5.6)						6 (60.0)				11 (2.3)
12					1 (1.1)		1 (0.8)					3 (60.0)			5 (1.0)
13							2 (1.6)						6 (100.0)		8 (1.6)
14	1 (4.5)	1 (3.4)			9 (10.0)	2 (1.6)	15 (11.9)	1 (25.0)		1 (50.0)		1 (20.0)		17 (68.0)	48 (9.8)
Total	22	11	1	12	90	128	126	4	28	2	10	5	6	25	488

(Row labels down the left side, from top: AC - Child)