THE NEED AND DEMAND FOR ORTHODONTIC TREATMENT IN URBAN AND RURAL SCHOOLCHILDREN IN SURABAYA, EAST JAVA - INDONESIA

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SUMMARY

The aim of the study was to obtain an objective measurement of the need and demand for orthodontic treatment among schoolchildren in urban and rural populations of Surabaya, East Java. One of the specific objectives was to obtain valid data and information that may assist in the development and planning of orthodontic services in this developing country.

The sample for this questionnaire, interview and clinical study included 2753 12 year old schoolchildren who were randomly selected in a stratified, two stage cluster sampling design, from elementary schools in urban and rural Surabaya. The sample consisted of 1477 schoolchildren from the urban and 1276 schoolchildren from the rural areas. A subsample of 686 parents of the schoolchildren (349 from urban and 337 from rural) who were involved in this survey was also selected.

Written questionnaires were used to collect data from the schoolchildren and their parents on: dental attendance and past dental treatment; dental health knowledge and behaviour; and perceptions and attitudes to need and demand for orthodontic treatment.

The **Index of Orthodontic Treatment Need (IOTN)** which consists of the **Dental Health Component (DHC)** and **the Aesthetic Component (AC)** was used in a clinical examination by the writer to measure the need for orthodontic treatment in the schoolchildren.

The schoolchildren from the Chinese ethnic group live mostly in urban areas and they showed a higher level of dental health knowledge when compared with the Javanese group also living in urban areas. The Chinese group had similar orthodontic treatment need but a slightly higher demand for services than the Javanese. From the questions on subjective demand for orthodontic treatment, it was revealed that the schoolchildren were likely to have a great motivation for having orthodontic treatment to improve the aesthetic appearance of their own teeth, significantly higher in urban compared to rural schoolchildren ($p<0.05$).
Urban schoolchildren have **more dental contact** and **services** than **rural. Occupation of father** was **related** to **dental attendance** in **rural areas. Parent potential demand** for **orthodontic treatment** for their **child** was **not as high as** that of the **schoolchildren.**

In a one-to-one interview by the dentist, the schoolchildren were asked to assess their perception of their own aesthetic dental appearance using the ten scaled colour **Aesthetic Component photographs**. The parents were also asked to make their judgement on their own child's aesthetic dental appearance using a black and white copy of the ten scaled **Aesthetic Component photographs** which was sent home to them together with a questionnaire similar to that completed by their child.

The prevalence of malocclusion of the schoolchildren in Surabaya involved in this study was considered high **(DHC - 68%, "definite" and "borderline" need for treatment)**; the most prevalent malocclusions found were **anterior crowding** and **protrusion** (44% and 30% respectively). The dentist assessment using **the Aesthetic Component** showed that **55%** of the schoolchildren were in **"need for treatment"** (borderline and definite need for treatment). The assessment by the dentist of schoolchildren with a **"definite need"** for orthodontic treatment was **23%** using **the Dental Health Component** and **17%** when assessed using the **Aesthetic Component.**

The schoolchildren's **self-assessment** on the **Aesthetic Component (AC)** revealed only **4%** of them in **"definite need"** treatment category, **6%** in **"borderline need"** and **90%** in **"no need treatment"**. This means that the majority of schoolchildren assessed their own aesthetic appearance at a very high level. In self-assessment of the Aesthetic Component, the **schoolchildren assessed their need much lower than assessment by the dentist**. Similarly, most of the parents considered their child's aesthetic dental appearance was good, which was also contrary to the dentist's assessment. Parent assessment of their child was slightly more favourable than the child's assessment. A highly significant difference was found between **the Aesthetic Component (AC)** assessments by **dentist, the schoolchildren** and their **parents** (Wilcoxon signed-ranks test : schoolchildren - parents $Z = -3.44$, $p < 0.001$; children - dentist $Z = -14.04$, $p < 0.0001$; parents - dentist $Z = -14.94$; $p < 0.001$). With **self-assessment and parent assessment**, the **Aesthetic Component did not appear to be a reliable index** in **assessing need** and **demand for orthodontic treatment** in **Indonesia.**

A good agreement was found between the **Dental Health Component (DHC)** and the **Aesthetic Component (AC)** from the **clinical assessment** by the **dentist (Kappa = 0.71, Spearman's rank correlation = 0.75)**. There was a **significant difference** in the **need** for **orthodontic treatment** ($p > 0.05$) but **no significant difference** in the **types of malocclusion** between the schoolchildren from **rural** and **urban** areas ($p > 0.05$).

The Index of Orthodontic Treatment Need is considered to be a good index to assess the orthodontic treatment need in Indonesia and the two components of the index have a high agreement and association in assessing the need.

It is suggested that dentists in public health centres in Indonesia should be introduced to the management of simple orthodontic treatment such as uncomplicated serial extraction cases in schoolchildren and the use of removable appliances.

STATEMENT OF ORIGINALITY

This thesis contains no material that has been accepted for the award of any degree or diploma at any University. To the best of my knowledge, no data presented in this thesis has been previously published or reported other than the abstracts, posters and papers that carry my name as an author.

The study presented in this thesis were performed by myself, except where otherwise acknowledged in the text, in the School of Dentistry, University of Airlangga, Indonesia and at the Faculty of Dentistry, University of Sydney, Westmead Hospital Dental Clinical School, between July 1993 and March 1998.

Thalca Agusni

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We will catch up the time that we have lost.

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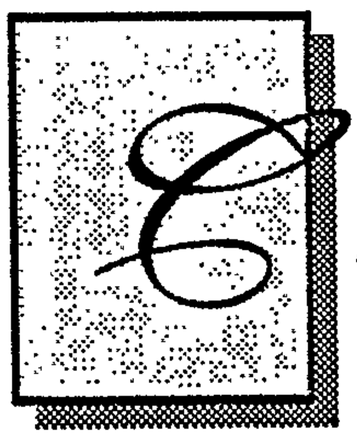


hapter One

INTRODUCTION (1 - 10)

Chapter One

INTRODUCTION

Malocclusion is still a dental problem in Indonesia and often neglected because more priority is given to the problems of dental caries and periodontal diseases. Most malocclusion cases are still not treated properly due to the ignorance of patients and the parents, inadequacy of dental resources, lack of dental workforce and many of the other factors that have influenced the availability of services. With the improvement of the socio-economic situation in Indonesia, the demand for orthodontic treatment is increasing quite rapidly. More patients with malocclusion problems visit dental clinics in the health centres in urban and the rural areas. Therefore good planning of orthodontic services on a large scale and in a systematic way is necessary. The planning of dental services should be based on valid measurement of both need and demand for orthodontic treatment of the population of the country.

Orthodontic treatment is expensive and undoubtedly not a simple treatment. It requires staff with specialist training, complex appliances and many patients visits over periods of one or two years or even longer. Thus, it must be considered as very sophisticated treatment in relation to other basic dental care procedures. Orthodontic appliances are worn by patients over long periods and make removal of plaque more difficult. Consequently, they carry the potential for encouraging dental caries and periodontal disease. Under unfavourable circumstances, appliance therapy may harm dental health and waste scarce resources. In a patient with poor oral hygiene, orthodontic treatment increases predisposition to dental caries and gingival disease **(Shaw et al. 1991a)**. Thus, orthodontic treatment should not be provided to patients having low levels of knowledge of preventive dental care or to those who are unable or unwilling to maintain good levels of plaque control. Because of these ideas, the planning of public orthodontic services must consider many inter-related aspects of dental health for the population under consideration:

- the level of awareness they have of malocclusion;
- level of demand and motivation for orthodontic correction;
- the level of malocclusion, expressed in terms of priority needs;
- dental caries prevalence and the need for restorative treatment;
- periodontal disease prevalence and need for treatment;

- knowledge of correct dental health procedures;
- practice of correct dental health procedures; and
- knowledge of the scope of dental services.

It is known from studies in Europe and the United States of America that all these factors are related to "life style" in terms of socioeconomic and cultural variables. However, it is not a simple thing to plan a particular type of orthodontic treatment service for the community in a developing country; it must be cost effective and efficient, since these countries only have limited resources. Yet, little if any research has been carried out in developing countries, such as Indonesia, to figure out the changes that occur in dental health and the demand for dental and orthodontic services as socioeconomic standards improve from subsistence level to comparative affluence. This was the area of investigation chosen for the present study which attempts to measure some of these factors in socially contrasting groups within the Indonesian population.

Background to Study

In the health sector in Indonesia, there has been a changing pattern of disease from the period of infectious diseases to that of the cardio-vascular and neoplastic diseases. The dental health awareness and attitudes towards dental health in the community are also changing for the better, as a result of dental health education programs as well as the improvement of the level of education and economy in this country. However, the basic problems of dental health in Indonesia still remain the same for dental caries and periodontal diseases.

The era of globalisation and the "open trade market" strategy in South East Asian Countries allows information from all over the world to be transferred very quickly and easily by the media of communication such as television, radio, film, magazines and even the Internet in the computer. It gives great influences to the way of life and culture of the community of the country. People have been motivated to have a new perspective of the way they look at the sense of beauty, by watching the commercials or advertisements on television or in magazines about the way in which teeth make people more attractive. Expectations are growing as the media shows different lifestyles to the young that indirectly affect orthodontic expectation. At this time they start to have a trend, to be aware of going to see the dentist not only for the tooth extraction, filling and periodontal problems, but also for other aspects of dentistry such as cosmetic dentistry including orthodontics. People now have the opportunity to consider "beauty" as a "need" in their life.

The definition of "Health" by the World Health Organization stated *"Health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity. Health is a basic human right for every individual regardless of race, creed, age, sex, income or geographical location"* **(WHO 1977).**

Orthodontics is one of the dental disciplines and dentistry is one of the health services. Thus, it can be stated that orthodontics helps to improve health in general and to improve the quality of life by helping people to feel better **(Godfrey 1990a)**. Oral diseases such as dental caries and gingivitis which are associated with discomfort and ill health, are usually easy to recognise. Malocclusion is not a disease, but is often compared with other physical abnormalities which are handicaps to good health and therefore like diseases. Malocclusion may also be a handicap to good health due to its bad effects on psycho-emotional factors of an individual and this is often argued as the main reason for orthodontic care **(Godfrey 1990b)**.

A few epidemiological surveys that have been carried out in Indonesia indicated that the prevalence of malocclusion among schoolchildren in Indonesia is considered high. Since over 40% of the population of the country is children, therefore malocclusion has become one of the problems in dental health that needs to be resolved. The possible aetiology of some malocclusion is due to factors which could be prevented or minimised, such as, early loss of the deciduous teeth because of the dental decay, intensive bad habits such as thumb-sucking or mouth breathing or possibly because of ethnic mixture marriage. The latter often happens in Indonesia, since this country consists of ethnic groups that have "different characteristic dentofacial features".

In the last ten years, the attendance of young patients to the Dental Health Centre and at the Orthodontic Clinic of the **Faculty of Dentistry, University of Airlangga** Dental Hospital has been increasing as young children become more conscious of their dental appearance. At the Orthodontic Clinic Airlangga Dental Hospital, which is the cheapest place for the provision of orthodontic treatment, the number of patients requesting treatment is overwhelming and consequently patients can not be treated or they have to wait for a long time for treatment.

It is a fact that untreated malocclusion in children may become more severe without any treatment

and, as a consequences, it will make the problem more complicated, and take a longer time to complete the treatment. As a result, the cost of treatment becomes much more expensive. On the other hand, there is also a lack of facilities, funds and manpower. Qualified orthodontists in Indonesia are very few compared with the general practitioners. Most of the orthodontists and general dental practitioners who provide orthodontic treatment are only available in the big cities; and not all of the general practitioners are interested in rendering simple orthodontic treatment to lessen the need of orthodontic treatment in such a large population (especially for the school-age children). As a result, the orthodontists could not provide a good service that will meet all the needs of the population.

How will the community solve their dental health problems, especially if they are having problems concerning their dental-facial appearance, where should they go for the treatment; if the need and demand of the services is high, how to provide good dental services to those population groups effectively and who will do all this work; what are the community's perceptions of orthodontic treatment (aesthetic appearance) and dental health care; are their perceptions of orthodontic treatment (aesthetic appearance) overshadowed by that of need for dental health care? The data collected from patient record cards at the Orthodontic Clinic at the **Faculty of Dentistry, University of Airlangga (1990)** revealed that almost all of the patients come for orthodontic treatment because of their parents' preference. Researchers claimed that parents have an important role in the successful outcome of the orthodontic treatment of their children **(Pietila & Pietila 1994, Espeland et al. 1992, Winoto 1989).**

Because orthodontic treatment is expensive, requires staff with specialist training, needs complex appliances and many patient visits over periods that require special attention in relation to other basic dental care procedures, good cooperation is needed between the children, their parents and their dentist to make the treatment successful. The parent's knowledge, attitudes and perception of malocclusion are factors which need to be known and investigated in Indonesia.

Concerning these problems, informative data is needed in facilitating a more comprehensive plan for dental health services in Indonesia. Therefore measurements of the need and demand for orthodontic care must be included in the dental treatment program, to give information that may

help to overcome the problem of malocclusion of the populations in urban and rural areas. For the success of planning of the dental services in this country, epidemiological research should be implemented. This may be aimed at how to obtain the information on need and demand for treatment, as well as the perception, knowledge and attitudes to the promotion of dental health.

These data may assist the effective planning of the dental health services which will be carried out by the Government Hospital or Dental Public Health Centres and may improve the dental health program in Indonesia. Finally, recommendations need to be made with regard to the problems relating to the provision of dental health care and orthodontic services in Indonesia.

Background Information of the Country, Indonesia

(Demographic, sociocultural and health care delivery system of the country)

Geographical Situation

The Republic of Indonesia is the largest archipelago in the world, straddling the Equator from 95° East Longitude to 141° East Longitude and 6° North to 11° South Latitude. The country, according to the last survey (1995), consists of 17.000 islands including the five main islands of Java, Sumatra, Kalimantan, Sulawesi and Irian Jaya. These islands stretch into the Indian and Pacific Oceans and lie between the Asian and Australasian continents. It covers an area of about 5,193,250 km^2 combining 2,027,087 km^2 of land and 3,166,163 km^2 of ocean. Due to its geographical position, the climate of Indonesia is humid and hot, with only two tropical seasons, the rainy and the dry seasons.

Administrative Structure of the Country

The country is divided administratively into 27 Provinces, each with a legislature and headed by a Governor. The Provinces are then divided into Regencies/Municipalities (Kabupaten/ Kotamadya) each with a legislature and headed by a Chief of Kabupaten/Major (Bupati/Walikota). The Regencies and Municipalities are autonomous regions, divided into Districts (Kecamatan), which are further divided into several Villages (Desa). The villages are administered by a selected Lurah (Village Leader). Each Desa is divided again into several Kampungs each with its own Kampung Chief. At the present Indonesia comprises 243 Regencies, 57 Municipalities, 3,837 districts and a total of approximately of 67,033 Villages (rural areas).

Population

Indonesia is the fourth most populous country in the world after the Peoples Republic of China, India and the United States of America **(DEPKES 1994)**. In 1994, the total population was 189 million with a density of about 97 per sq km. Population distribution is very uneven; the majority of the population is concentrated in Java and Madura Islands. Among the five biggest islands, Java is the most densely populated with almost 60 per cent of the total population, in only 7 per cent of the country's land space. The rest of the population is distributed between Sumatra (19%), Kalimantan (4.5%), Sulawesi (7.1%) and the other islands. The population density in Java in 1983 was 704 persons per sq km while in other areas it was around 30 **(DEPKES 1994)**. The population is expected to reach about 220 million by the year 2000.

The capital of Indonesia is Jakarta, which is located on the island of Java and is the largest city in the country with a population of about 10 million which is expected to increase to about 12 million by the year 2000. Surabaya is the second largest city, located in East Java, with a population of about 4.5 million. Generally, in the day time, the population of the big cities increases by up to 10 per cent due to the daily urbanisation/commuters of people from rural areas who come to work in the cities and return at night. Similarly, in the rainy season, there is a seasonal change and more people return to rural areas to do field work as farmers.

Around 60 per cent of the population still live in rural areas; but the rural situation in Java Island is different from other rural areas outside this island. Due to the good transportation and telecommunication system, as well as the public information sources such as television, radio, newspapers and magazines, living in rural areas in Java is not "uncivilised" when compared with any other islands of the country.

Over 40 per cent of the population of the country is children. The population ratio between female and male is about equal i.e 50 per cent (94,300,000 male : 94,800,000 female).

Distribution by age	: Children	0-4 yrs.	21,000,000
	Adolescents	5-14 yrs.	44,500,000
	Young Adults	15-19 yrs.	19,000,000
	Adults	20-54 yrs.	79,000,000
	Older Adults	55-64 yrs.	9,500,000
	Elderly	65+	7,000,000
Annual Population Growth	: 1.8%		
Urban population	: 40%		

There are about 350 ethnic groups in Indonesia and around 300 distinct dialects. However, the national language is Bahasa Indonesia. Literacy rate is 88% in males and 73% in females.
The per capita income according to the World Bank was reaching US$800 per annum in 1995, but was previously lower at US$ 670 (1992). In the last 5 years Indonesia's economy increased at an average rate of 3-4% annually, and if maintained at this rate, it may assist in accelerating the country's development program including health.

Health Facilities, Dental Work Force and Education (DEPKES 1990)

Hospitals	: 744
Health Centres	: 5,656
Dental Health Centres	: 3,581
Dentists	: 5,838 (graduated in 1979-1990)
Number of dentist graduated per year	: 560
Number of specialists graduated per year	: 13
Dental assistants	: 3,194
Dental assistants graduated per year	: 540
Number of Dental Schools	: 11 (6 Government and 5 Private)
Number of Schools for Dental Nurse	: 18 (all Government)
Number of Schools for Dental Technician	: 1

Ratio of Dentists to Population is different in each province;

- ranging from 1:14,635 (Jakarta) to 1:198,215 (Nusa Tenggara Barat).

Fluoridation of public water supplies has not been introduced to Indonesia and there are few natural fluoride areas and a very low prevalence of fluorosis. Virtually all toothpastes on the market in both urban and rural areas contain fluoride. **(Effendi 1996)**

Oral Health Status (DEPKES 1990)

Urban areas:

Dental caries

DMFT per person	(1979-1984)	(1984-1988)
-at 8 years of age	: 1.1	0.9
-at 14 years of age	: 2.6	2.7
-at 35-44 years of age	: 4.6	8.7
The prevalence of dental caries	(1979-1984)	(1984-1988)
-at 8 years of age	: 51%	45%
-at 14 years of age	: 73%	73%
-at 35-44 years of age	: 78%	87%

Periodontal disease

Average sextants affected	(1978-1984)	(1984-1988)
-at 8 years of age	:1.9	1.5 sextants/calculus
-at 14 years of age	:2.2	2.6 sextants/calculus
-at 35-44 years of age	:2.5	4.0 sextants/calculus
The prevalence of periodontal disease		
	(1978-1984)	(1984-1988)
-at 8 years of age	: 58%	58%
-at 14 years of age	: 62%	73%
-at 35-44 years of age	: 69%	88%

Rural Areas:

Dental caries

DMFT per person	(1978-1984)	(1984-1988)
-at 8 years of age	: 0.9	0.8
-at 14 years of age	: 2.1	2.5
-at 35-44 years of age	: N.A	N.A
The prevalence of dental caries	(1978-1984)	(1984-1988)
-at 8 years of age	: 44%	40%
-at 14 years of age	: 67%	71%
-at 35-44 years of age	: N.A	N.A

Periodontal disease

Average sextants affected	(1978-1984)	(1984-1988)
-at 8 years of age	: 2.1	1.7 sextants/calculus
-at 14 years of age	: 2.4	3.5 sextants/calculus
-at 35-44 years of age	: N.A	N.A
The prevalence of periodontal disease		
	(1978-1984)	(1984-1988)
-at 8 years of age	: 63%	60%
-at 14 years of age	: 69%	89%
-at 35-44 years of age	: N.A	N.A

Health Care Delivery System

The nation is developing a health care delivery system which started in the 1970's with the introduction of the referral system in Community Health Care. This system is trying to achieve the utmost efficient and effective way of health care for the community with special regard to the geographic, demographic and sociocultural background of the nation and also taking into special consideration the economic development which is gradually improving .

The system consists of stratification of health services, starting from "what can be done" by the community through the practice of self-care as the basis of community participation, coming up to the professional health care delivery in primary health care at the Health Centre (Puskesmas). The hospital care starts from hospital Type D (a hospital with a general medical practitioner), Type C (a hospital with seven basic specialists), Type B (a hospital with a full range of specialities but with limited sub-specialities) and the highest referral in the system is the Type A Hospital (a hospital with full specialities and sub-specialities services). In this system, it is expected in principle, a patient does not need to make an unnecessary visit to the hospital or the health centre. Theoretically, this system should be a very effective and efficient way of supplying health services **(Effendi 1996).**

Dental Health Services

Dental Health Services in Indonesia are carried out basically by government and private sectors. Most of the services are delivered by the Government and administered at 5 levels of services; **Sub-district** level health services are integrating by the Community Health Centre (Pusat Kesehatan Masyarakat / Puskesmas) as the front-line health unit. The Puskesmas have the task to maintain and develop the health of the population. It has also a task for stimulating the communities to actively participate in health maintenance and development activities that form an integral part of the socioeconomic development.

There are 12 basic health services provided by the Puskesmas; Medical Care, Maternal and Child Health, Family Planning, Communicable Disease Control, Environmental Hygiene, Community Health Nursing, Health Education, Nutrition, School Health Services, Dental Health, Mental Health and Laboratory Services. Some Community Health Centres, especially in rural areas, provide only very limited basic health services including dental health services that offer only relief

of pain, filling and extraction. Complicated cases are referred to regency or provincial hospitals and the highest referral is to the central level to type A Hospitals where all kinds of treatment are available. The active involvement of the community and their leaders in self care is a very important attitude to improve the healthy life for the whole community **(Effendi 1996)**.

District level services are also rendered by Community Health Centres. A district could have more than one Community Health Centre depending on the total population covered and the size of the area.

Regency and Municipality level covers several Community Health Centres that render basic health care services.

Provincial level services consist of two organisations; Department of Health (Kantor Wilayah Departemen Kesehatan) and Office of Health Services (Dinas Kesehatan Dati I).

A Provincial Dental Officer is responsible for the oral health programs in its territory to the Provincial Medical Officer who manages the whole administrative structure at this level.

Central level service is carried out by the Directorate of Dental Health that is under the Ministry of Health. It is managed by a Director who has a responsibility in national dental health care policy including directing, planning, monitoring and evaluating the national dental health services.

In the regency, provincial and central levels, general and dental health care are rendered by hospitals. In some big cities that have dental schools, dental care is also available at the dental school clinic. Compared with the Community Health Centre, hospital services are more clinical and less community oriented, more curative and less preventive.

As previously mentioned, there are four types of hospitals i.e: Type A, B, C, D. Basically, Type D Hospitals are at the regency level, Type C and B at the provincial level whereas Type A hospitals are available at the central level. The private sector is located mostly in urban areas and renders mainly curative treatment to a certain group of the community on an individual basis.

hapter Two

OBJECTIVES AND HYPOTHESES (11-14)

Chapter Two

OBJECTIVES AND HYPOTHESES

Introduction

Over recent years the demand for orthodontic treatment in Indonesia has increased dramatically as the socioeconomic standards of the country improved. In the 1970s per capita income was about US$500 per annum, US$670 in 1992, US$800 in 1995 and in 1996 according to the World Bank Reports, per capita income was reaching US$1000 per annum.

With many dental health problems in Indonesia there is inadequate data available to assist planning and development of dental health care delivery systems. A few studies have shown that, in general, the dental health of the population is relatively not very good. The main problems are still dental caries and periodontal diseases; for example, the prevalence of the disease in the 8 year old group of children is 55 - 59% and in a group of 35 year olds is 80 - 89% **(DEPKES 1990)**.

The prevalence of malocclusion among schoolchildren is considered high. **Kuswahyuning (1977)** claimed that in Yogyakarta the prevalence of malocclusion of 12 year old children is 75% and in Surabaya the prevalence among 12 year old schoolchildren is 65 - 80% **(Pambudi 1978)** and 35% of those have severe malocclusion with a definite need for orthodontic treatment. **Djokosalamoen (1983)** claimed that the prevalence of malocclusion of 12 year old children in Surabaya is 72%, while 33% of those have a great need of treatment and 11% need extraction for their orthodontic treatment. All of these reports came from dental clinics in big cities and most of the patients studied were from the urban population.

From the literature studied, there was no report on the subject of malocclusion among the children from rural communities in Indonesia. Since the majority of the Indonesian population are living in the rural areas, those data reported do not reliable represent the real situation in this country. There is, therefore, a need to know the situation of malocclusion amongst the schoolchildren in the rural communities and to compare this with the urban situation.

The need and demand for orthodontic treatment will be strongly influenced by many factors including the educational and socioeconomic background of the family. The parents perception of the dentofacial appearance of their children will also influence their motivation toward seeking orthodontic treatment.

The best motivating factor for requesting orthodontic treatment is desire for aesthetic improvement **(Albino et al. 1981)**. Many orthodontic patients and their parents have expectations of improved social acceptance and self-esteem resulting from treatment **(Dorsey & Korabik 1977, Shaw et al. 1979)**. This implies that the demand is often based on psychological rather than somatic factors **(Prahl-Andersen 1978, Mohlin 1982)**.

With the new index and technique for assessment of malocclusion severity (The **Index of Orthodontic Treatment Need**), it is now possible for the dentist to make a simple and objective assessment of dentofacial appearance that could be compared with subjective self-assessment by the patients or their parents. Having all of these in mind, the present study was conducted in samples of schoolchildren and their parents from both urban and rural populations in Surabaya, East Java.

Aim of the Study

The aim of the study was to obtain an objective measurement of the need and demand for orthodontic treatment among schoolchildren in the urban and rural populations of Surabaya, East Java, Indonesia.

Specific Objectives of the Study

1. To obtain information about dental attendance and past dental treatment among schoolchildren in Surabaya and their parents, by a written questionnaire.

2. To obtain information about dental health knowledge and behaviour among schoolchildren in Surabaya and their parents, by a written questionnaire.

3. To analyse data from the written questionnaires in relation to the locality, ethnic group, gender and father's occupation.

4. To obtain information about the knowledge of orthodontic treatment among schoolchildren in Surabaya and their parents, by a written questionnaire.

5. To obtain information about the demand for orthodontic treatment among schoolchildren in Surabaya and their parents, by a written questionnaire.

6. To obtain data on the need for orthodontic treatment among schoolchildren in Surabaya by a clinical examination of the teeth, using the Index of Orthodontic Treatment Need (IOTN).

7. To analyse the data from the IOTN clinical examination in relation to the locality, ethnic group, gender and father's occupation.

8. To compare the assessments of the Aesthetic Component (AC) of the IOTN by the schoolchildren, parents and dentist.

9. To measure the consistency between the Dental Health (DHC) and Aesthetic Components (AC) of the Index of Orthodontic Treatment Need (IOTN) in an Indonesian sample.

10. To determine whether the IOTN is an appropriate index for use in an Indonesian sample.

11. To obtain valid data and information that may assist in the development and planning of orthodontic services in this developing country.

The Working Hypotheses

The following working hypotheses were selected for testing

1. Urban schoolchildren are likely to have more dental experience, more basic dental knowledge and better dental services at their school compared with rural schoolchildren.

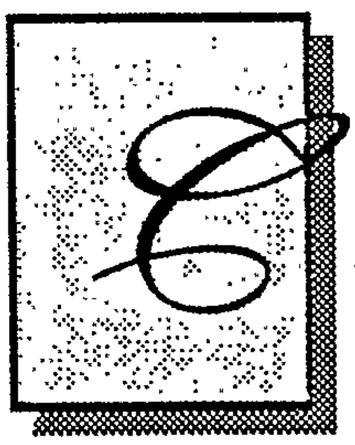
2. There is a difference in the need and demand for orthodontic treatment between urban and rural schoolchildren.

3. Ethnic group, gender and father's occupation are factors that have some influence on the need and demand for orthodontic treatment.

4. Parent demand for orthodontic treatment for their children is likely to be higher than that of the schoolchildren.

5. Self assessment of the Aesthetic Component (AC) by the schoolchildren will be different from the assessment of the children by their parents and by the dentist.

6. The Index of Orthodontic Treatment Need (IOTN) is a good index for the assessment of the need and demand for orthodontic treatment in an Indonesian population.



hapter Three

LITERATURE REVIEW (15 - 31)

Chapter Three

LITERATURE REVIEW

To plan an adequate and an effective dental service, especially in a developing country like Indonesia, the need and the demand for the services of the population should be identified. "adequate" means if the proportion of the population covered by the services is achieved and "effectiveness of a service" means the degree to which the objectives are achieved **(Holloway 1991)**. An important aspect of the effectiveness of a service is the extent to which the service matches the needs and the demands of the population.

Over recent years the demand for orthodontic treatment in Indonesia has increased dramatically as the socioeconomic standards of the country improved. Orthodontic treatment is provided based on need and demand for the treatment, and the perception of need and demand are influenced by many factors. This literature review will deal with the need and demand for orthodontic treatment and will review indices used to measure orthodontic treatment.

Definition of Need and Demand

Needs according to the Dictionary of Epidemiology **(Last 1988)** is a term which has a precise and an all-but-indefinable meaning in the context of Public Health (Syn: health needs, perceived needs, professionally defined needs, unmet needs). In precise numerical terms, it refers to specific indicators of disease or premature death that require intervention because their level is above that generally accepted in the society in question. For example an infant mortality rate two or three times greater than the national average in a particular community is an indicator of unmet needs of infants in that community. This is not to be confused with a need for more or better medical care. It should be clear that even in this seemingly precise usage there are implied value judgements. It must be explicitly stated that "needs" always reflect prevailing value judgements as well as the existing ability to control a particular public health problem. Thus, the ill effects of cigarette smoking must now be universally acknowledged as a health need; child abuse is increasingly regarded as a public health problem, to which we could apply the term "professionally defined need."

According to dental professionals, **need** is a professionally defined quantity of care that is required to achieve or maintain health optimal for a particular patient. Felt need (wants) are the quantity of care individuals themselves feel that they need **(Striffler et al. 1983)**. Need for dental treatment can be measured and expressed in several ways and the need for dental service often is confused with the demand for care. One can be aware of a need but not demand care for it, or one may not have the ability to obtain dental services to satisfy the needs.

Demand is the willingness and/or the ability to seek, use and in some settings to pay for services **(Last 1988)**, sometimes further subdivided into "expressed demand" (equated with use) and "potential demand" or "need".

Effective demand: demands that always have to be fulfilled by finding the service.

Social demand: demands that develop due to cultural pressure, created by the community.

Proffit (1993) described demand for orthodontic treatment as indicated by the number of patients who actually make appointments and look for treatment, and not necessarily ones with or without malocclusion or deviation in facial appearance. Some persons do not realise they have a problem while others feel that they need treatment but cannot afford it or the service is not available.

From the economist's viewpoint, **demand** is the quantity of service that a patient will buy at a given price. The lower the price the larger the quantity that the patients are willing to buy. Explicitly, the quantities supplied and demanded will change as prices change.

Supply is defined as the quantity of a service that will be provided at a given price. The higher the price, the larger the quantity that suppliers are willing to make available **(Striffler et al. 1983)**.

Demand for service varies in different areas of the countries, in developed and developing countries, or in contrasting socioeconomic strata, and it may change between time periods. It can be influenced by a number of factors such as education, economic improvement or cultural pressures. The higher the income, the greater the demand for orthodontic treatment; also in fact, good facial appearance and avoidance of disfiguring dental conditions are associated with more prestigious social positions and occupations **(Proffit 1993)**.

Development of Need and Demand for Dental Services in a Developing Country

The need and demand for dental services will be varied in different areas in the world or in different areas of a country. It can be influenced by many factors such as age, gender, income, availability of services, education, cultures, life style and other individual factors. The need for dental care is the presence of ill health as perceived by the individual and as assessed by the dental professional.

In most of the developed countries the dental health services have applied preventive dental programs to reduce dental caries and dental diseases by water fluoridation, to control diet and to provide dental health education programs to their community.

In some less developed countries, the meaning of adequate and effective dental services might be different; maybe it is considered adequate, simply to relieve acute dental pain and extract decayed teeth. However, this does not preclude the provision of dental health education which may lead to the prevention of dental disease, but may also lead to a rapidly increasing demand. Nevertheless, an effort should be made to assess the readiness of the community for better dental services and to provide dental health education in order to achieve good results.

Need and Demand for Dental Care

Spencer (1980) stated that need may be estimated by four different approaches, differentiated by the basic sources of data. These are: firstly from surveys of dental status; then secondly surveys of need for dental care; thirdly analysis of service or treatment records; and finally the best judgement of the dental practitioner. The treatment needs of an individual are determined both by the attack of dental diseases and by the amount of dental care received. The most important factor determining the amount of treatment needed by a group is its past utilisation of dental services **(Striffler et al. 1983)**.

Demand for Dental Care

The United States Department of Commerce reported that in 1966 people spent more money for tobacco and alcoholic beverage than for their health care **(Dunning 1986)**; only 42% of the population have seen the dentist in the past year and high income families (64%) tend to see the

dentist more often than those with lower income (23%) and 17% of the whole population have never seen the dentist. However, even if the financial barriers were removed, the utilisation of the dental service is still far from complete. It still needs very strong effort to persuade persons to utilise the dental service.

Need and Demand for Orthodontic Treatment

Orthodontic treatment usually involves the use of a removable or fixed appliance, or the combination of both. Patients have to attend for adjustment at regular intervals for a minimum of a year or even longer. It requires commitment and co-operation from the patients and the parents to achieve successful treatment.

Demand for treatment may arise from the requirements of the patients or as a result of the dental practitioner's assessment of the patient's condition. What the professional assesses as the patient's need is defined as the normative need. Perceived need is what the patients think they need, i.e. perception of their own need. The need for services is often confused with the demand for care. Demand is varied in different areas of countries and is also different in contrasting socioeconomic strata and also between periods **(Reid 1967)**. This means, it will change from time to time and will be different between the developed and developing countries. Demand also can be influenced by a social factors such as education, economic improvement or cultural pressures (social demand).

Need for Orthodontic Treatment

A standardised means of defining treatment need has two main applications. Firstly, it can be used to predict and assess the outcome of treatment on referred populations so having an influence on patient commitment, and secondly it can be used to measure the treatment need of non-referred populations. Many clinicians have recognised this potential and the abundance of indices which have been developed are witness to this **(Malmgren 1980)**. The aims of orthodontic treatment according to the **British Dental Association** Memorandum on Orthodontic Services **(1954)** are to produce improved function by correction of irregularities and to create not only greater resistance to disease but also to improve personal appearance, which later will contribute to the mental as well as the physical well-being of the individual. Dental and facial appearance is a major factor in the perception of need for orthodontic treatment.

Brook and **Shaw (1989)** after research into health factors influencing desirability and benefits of orthodontic treatment, and realising that aesthetics are a major component of perceived and normative need, developed the Index of Orthodontic Treatment Need (**IOTN**). Perception of orthodontic treatment need is highly subjective and varies between the three parties involved; the public, the general dentist and the orthodontic specialist **(Shaw et al. 1975)**. Orthodontists, as specialists in the alignment of teeth and correction of malocclusion, have a more critical approach to malocclusion than other dentists and the lay public **(Shaw et al. 1980)**.

Prahl-Andersen et al. (1979), Albino et al. (1981) and some other private orthodontists reported that the major motivation of most patients seeking orthodontic treatment lay primarily in cosmetic reasons rather than significant functional disability. They come not on referral from the general dentist, but because they have seen his work on a friend and they like the way it looks **(Cohen 1970)**.

Functional and Dental Health Indications for Orthodontic Treatment

Need for orthodontic treatment is difficult to measure. Need refers to the number of individuals who have an orthodontic problem and may benefit from the treatment. When evaluating the objective need for the treatment, it is also important to consider the needs in term of the function of the masticatory system and the benefits of orthodontic treatment. The latter might be divided into the correction of malocclusion and its effects on dental health i.e. general oro-facial disorders, dental caries and periodontal disease, and improvements in the psychological well-being of the children and their social interaction with their peers. In a situation where the facilities are inadequate and the orthodontic resources are limited to meet the perceived needs of the patients then those most in need should receive priority for treatment.

Function of Masticatory System

A study by **Malmgren (1980)** suggested that among children with normal occlusion, occlusal stability does not seem to differ before and after the eruption of permanent teeth in the lateral segments. The study has not provided any clear support for the hypothesis that postnormal occlusion gives rise to such a degree of functional disturbances that the need for orthodontic treatment is augmented. There is still a question of which functional disturbances may develop later, with or without orthodontic treatment in individuals with postnormal occlusion.

Proffit (1986) claimed that a severe malocclusion does not render mastication impossible but may require physiological compensation for the anatomic deformity, for example in skeletal Class III Angle patients and those with an anterior open bite, who find it difficult to incise the food.

General Oro-facial Disorders

Severe general oro-facial disorders such as defects of cleft lip and/or palate, severe overjet which increases trauma, reverse overjet greater than 3.5mm with reported masticatory or speech difficulties, impeded eruption of the teeth which might create a risk of adjacent root resorption and extensive hypodontia with restorative implications are considered as functional disturbances of the masticatory system. Children with such cases must have priority for treatment because they have great difficulties in masticatory function and/or speech as well as the cosmetic disturbances.

Todd and **Dodd (1985)** in the Child Dental Survey of England and Wales 1983 claimed that nearly 50 per cent of children aged 12 years and over with overjet of 9 mm. or more had sustained traumatic accidents to their incisors. **Jarvinen** and **Vaataja (1987)** found the prevalence of traumatised incisors with 6 mm. overjet or greater is 38.6 per cent whereas it was only 14.2 per cent for an overjet of 0 - 3 mm. Early correction of proclined upper incisors reduces the risk of trauma, although the potential benefit becomes less with age **(Shaw et al. 1991a)**.

Temporo-Mandibular Joint Dysfunction

There is a considerable divergence of opinion regarding the role of malocclusion in the aetiology of temporo-mandibular joint dysfunction. The number of people with mild to moderate malocclusion far exceeds those with temporo-mandibular joint problems; it seems unlikely, therefore, that malocclusion has a major aetiological role. On the other hand, **Mohlin** and **Thilander (1984)** claimed that Class III Angle malocclusion in males, crossbite and open bite showed the strongest correlation with temporo-mandibular joint dysfunction. However, because of its multifactorial aetiology, the need for treatment as a preventive measure still remains questionable, but the subjective symptoms of temporo-mandibular joint dysfunction in the presence of a malocclusion may indicate a need for orthodontic treatment. Symptoms of temporo-mandibular joint dysfunction include pain, clicking joint and trismus **(Perry 1968)**.

Periodontal Disease

According to some studies it was found a relationship existed between dental irregularities and periodontal disease **(Ainamo 1972, Sandali 1973, Buckley 1972)** but other researchers have failed to find a causal link **(Beagrie & James 1962, Ingervall et al. 1977)**. Although tooth irregularity had a statistically significant effect on plaque accumulation, the impact was not great enough to change the experience of gingival disease at a clinically important level. Even if orthodontic treatment could improve the gingival condition, the most important factors are still the personal feelings towards the oral hygiene skill and attitudes of the patients **(Shaw et al. 1991a)**.

Dental Caries

The relationship between malocclusion, plaque accumulation, gingivitis and dental caries is still controversial and this is due to their multifactorial aetiology and is reflected in different results of research. **Miller** and **Hobson (1961)** found that caries rate is higher with malocclusion and this indicates the importance of preventing or reducing the incidence of malocclusion as a basis for prevention of caries. Similarly, **Hixon et al. (1962)** found that dental students with untreated malocclusion had a higher DMF score than those without a malocclusion. However, the causal association between malocclusion and increased caries risk has not been proved by other researchers. **Katz (1978)** claimed that individuals with crowded upper incisors have lower caries incidence and **Helm (1968)** failed to prove that certain types of malocclusion lead to an increased risk of tooth loss. On the other hand, **Miller** and **Hobson (1961)** found that early extraction of carious teeth may lead to malocclusion. Similar to periodontal problems, the factors that might reduce the caries incidence are the better awareness, motivation and attitude of the individuals to maintain their personal oral hygiene, regular visits to professionals, and advice on diet.

Socio-psychological Well Being of Patients

Severe malocclusion may relate to the socio-psychological well being of the children if they are being teased or insulted with hurtful nicknames. It is claimed from studies in social psychology that unattractive physical appearance can produce an unfavourable response in social interaction. However, there is little evidence to suggest that children with unattractive dentition suffer social or psychological disadvantages **(Shaw 1981b)**.

Measurement of Need and Demand for Orthodontic Treatment

At a time of increasing demand for orthodontic treatment, together with economic constraints on the people within the country, the elimination of unnecessary treatment of minor malocclusion may encourage the treatment of fewer cases, but to a higher standard, thereby minimising the possible harmful effects of poor treatment.

An index, with the capability of identifying individuals whose malocclusion represents a risk to either the function or longevity of the dentition or the socio-psychological order of treatment priority, would allow optimum deployment of the available resources both in terms of finance and manpower. To decide whether a patient needs an orthodontic treatment, an index is used to evaluate the severity of malocclusion. The index is not only used for screening and measuring the need for treatment, but it may be used for many other purposes. The uses of orthodontic indices are: first, screening for handicapping malocclusion; then ranking subjects for priority treatment; and finally, for epidemiological surveys of malocclusion **(Carlos 1970)**.

Requirements for an Index

The term "index" has been defined by **Young** and **Striffler (1969)** as a numerical value describing the relative status of a population on a graduated scale with definite upper and lower limits, designed to permit and facilitate comparison with other populations classified by the same criteria and methods.

With the notable exception of the Angle's classification **(Angle 1899)** and its modifications, used as a descriptive classification, there is not as yet a universally accepted index of malocclusion of orthodontic treatment need. No one method appears to be equally suitable for use by epidemiologists, public health planners and clinicians.

Draker (1960) and **Summers (1971)** suggested that an ideal index should have certain features.

* The index should be clinically reliable. It should be able obtain the same measurement if it used by other examiners for measuring the same object.
* It should be clinically valid, which means it should measure what it is intended to measure and therefore be acceptable to both the dental profession and the public.

* The index should yield quantitative data that may be analysed using parametric or non parametric statistical tests.
* Furthermore, it should have the ability to be applied quickly, even by examiners without special instruction or orthodontic expertise, so that it should be simple to learn and to use.
* Finally, it should be applicable to either examining patients or their dental models.

Types of Indices

Several types of indices of malocclusion have been developed and are used for different purposes.

* One of these is for diagnostic classification where they are used as an aid to clinical diagnosis and treatment planning; for example, *Angle's Classification* has been used for this purpose. However, the reliability of the Angle's classification has been questioned because of high intra- and inter-examiner errors, and in addition it cannot be used to identify or to rank the severity of malocclusion and therefore the need for treatment.
* A second use of these indices is to collect epidemiological data. Indices for this purpose were developed to describe the prevalence of various occlusal traits within a population; for example, the *Epidemiological Registration of Malocclusion* developed by **Bjork et al. (1964)**. However, this index tends to be complicated and time-consuming, recording all deviant occlusal anomalies but not necessarily assessing the need for treatment.
* A third use is to describe treatment complexity. These indices attempt to classify cases into those in which treatment could be the best undertaken within the range of competence of the nonspecialist, the orthodontic specialist and a specialist interdisciplinary team. For example, **Gardiner (1956)**, **Foster** and **Walpole Day (1974)**, **Crabb** and **Rock (1986)**, **Haynes (1973)** and **Robertson et al. (1987)** all described indices that attempted to delineate the complexity of treatment to plan for the resources required.
* A further use is to measure the treatment need in a population to screen a population and assign priority to cases and to enable planning of resources of both staff and facilities. Examples are *Handicapping Labio-lingual Deviation* **(Draker 1960)**, *Treatment Priority Index* **(Grainger 1967)**, *Handicapping Malocclusion Assessment Record* or *HMAR* **(Salzmann 1968)**, *Occlusal Index* **(Summers 1971)**, the *Swedish National Board for Health and Welfare Index* **(Linder-Aronson 1974)**, *Index of Need for Orthodontic Treatment* or *INOT* **(Ingervall & Ronnerman 1975)** and the *Index of Orthodontic Treatment Need or IOTN* **(Brook & Shaw 1989)**.

* Another use is to record aesthetic impairment with the *Photographic Index* **(Banack et al. 1972)**, *Dental Aesthetic Index* **(Cons et al. 1986)** and the *SCAN Index* **(Evans & Shaw 1987)**.
* Another application of indices is to record treatment success standards. These compare pre- and post-treatment records to register the outcome of orthodontic care; for example, the *Occlusal Index* **(Summers 1971)** and the *Peer Assessment Rating* or *PAR* index **(Richmond et al. 1992)**.

However, most indices may be used for more than one purpose.

Indices of Orthodontic Treatment Need

Development of Methods of Measuring the Need for Orthodontic Treatment

Need for orthodontics treatment is difficult to measure. Need refers to those individuals who have an orthodontic problem and may benefit from the treatment. Dental and facial appearance is a major factor in the perception of need for treatment. Usually, patients request orthodontic treatment primarily for cosmetic considerations whether or not they experience significant functional disability. **Bowden** and **Davies (1975)** claimed that the main purpose of an occlusal index is to interpret malocclusion severity objectively in terms of treatment need. There still remains an inevitable element of subjectivity in the interpretation of treatment need based on the clinician's perception of malocclusion.

Private orthodontists report that most of their patients come primarily for aesthetic reasons. They come not on referral from the general dentist, but because they have seen his work on a friend and they like the way it looks **(Cohen 1970)**. **Prahl-Andersen (1978)** discussed the concept of perceived need for orthodontic treatment in contrast to demand for treatment; with the determination of need based on three types of information gathered in the medical field to judge a person's health or condition; objective signs, subjective symptoms, and social sufficiency.

* **Objective signs** include deviation from a prognostic optimal norm. This is only permissible if it is proved that the group of individuals on which the norm has been based actually are less ill or have fewer defects, better development, function better, or adapt better than other groups.
* **Subjective symptoms** include the recognition by the patient of deviation as a problem requiring a treatment. For children this recognition usually comes from the parents.
* **Social sufficiency** involves the recognition by society that the patient's malocclusion creates a problem for the patient.

Indices Used to Measure Need for Orthodontic Treatment

The desire to distinguish patients who need orthodontic care led to development of several indices for malocclusion as methods of determining the level of treatment need. There are a lot of indices which have been developed over the past century in the search for the ideal index. With these general requirements in mind, some of the indices which have been proposed for the measurement of orthodontic treatment need are reviewed. Among these are the *Malalignment Index* of **Massler** and **Frankel (1951)**, the *Malalignment Index* of **Van Kirk** and **Pennell (1959)**, the *Handicapping Labiolingual Deviation* index of **Draker (1960)**, The *Treatment Priority Index* **(Grainger 1967)**, the *Handicapping Malocclusion Assessment Record* **(Salzmann 1968)** the *Occlusal Index* **(Summers 1971)**, the *Dental Aesthetic Index* **(Cons et al. 1986)** and the *Index of Orthodontic Treatment Need* **(Brook & Shaw 1989)**.

The World Health Organization (WHO 1977) suggested three grades of malocclusion, the first being no anomaly. Twisted or tilted tooth, or slight crowding, or spacing is considered to be a slight anomaly; and anomalies that are generally regarded as causing an unacceptable effect on facial appearance, or a significant reduction in masticatory function, or impairment of speech are considered to be more serious. Gross defects such as cleft lips, cleft palate and pathological or surgical injury are recorded separately under "other condition". The prevalence of these conditions is usually low and valid data can only be obtained from analysis of treatment records.

The WHO codes used for recording malocclusion are as follows:

0 - No anomaly or malocclusion
1 - Slight anomaly, such as one or more rotated or tilted teeth, or slight crowding, or spacing, which disturb the regular alignment of the teeth;
2 - More serious anomalies, specifically, the presence of one or more of the following conditions of the four incisors
    - maxillary overjet estimated to be 9 mm or more
    - mandibular overjet, anterior crossbite equal to or greater than a full tooth depth
    - open bite
    - midline shift estimated to be more than 4 mm; and
    - crowding or spacing estimated to be more than 4 mm

However, the WHO system still needs to be developed to avoid subjectivity even though it is still considered to be one of the best choices.

Massler and **Frankel (1951)** proposed a quantitative method for evaluating the prevalence of malocclusion and orthodontic treatment need in population groups for epidemiological purposes (*Malalignment Index*).

* The index is based on direct measurement of each individual tooth, to determine whether it is in correct occlusion or maloccluded or missing.
* The number of maloccluded teeth in each individual is counted and the mean value is used to evaluate the prevalence of malocclusion in groups.
* The evaluation of the occlusion of a given individual results in a number from zero for a dentition with no maloccluded teeth to twenty eight if all the teeth were maloccluded.
* The term malocclusion was reserved for those patients in whom the malpositioning of the teeth was sufficiently severe in degree to require orthodontic treatment, and/or any case having more than 10 malpositioned teeth.
* Each case was categorised into mild, requiring only short term preventive or palliative measures, then moderate, requiring more prolonged but simple treatment, and severe, which requires long term intensive or complicated treatment.

Massler and **Frankel (1951)** used this method in a survey of 2,758 children of 14 - 18 years in high schools in Illinois, USA. They found that 79 per cent of the children had malocclusion requiring treatment. Only three per cent had ideal occlusion, while 18 per cent had less than 10 mildly malposed teeth which did not require orthodontic correction. However, this method was abandoned because of poor reliability and because it was too subjective. The assessment was time-consuming and impractical for epidemiological purposes.

Poulton and **Aaronson (1961)** considered that it was difficult to judge the conformity of each tooth to its ideal position in all planes and that these problems caused major inconsistencies in scoring. In addition, no attempt was made to assess the validity of their index as a method of prioritising treatment need so that it failed to meet most of the ideal requirements of an index.

Van Kirk and **Pennell (1959)** designed an index to measure the malalignment of the teeth in the labial and buccal segments of the arch *(Malalignment Index)*.

Scores were applied to each segment and totalled to give the individual score. Using this method, 2,100 schoolchildren aged 12 - 15 years in Washington DC, USA were examined. They found that

the average malalignment score was 7.5, and ranged from 0 to 21. The *Malalignment Index* demonstrated a progressive increase in average scores from the age of 12 to 15 years. The increase is three times as great in the posterior as in anterior segment of the jaws. In the age groups studied the largest contribution to the total score was made by the mandibular anterior segment, but as age increased the differences became progressively less apparent. The average time taken to score a patient was less than one minute. Finally, the results of examinations performed by two dentists showed poor reliability and the validity was not tested.

Draker (1960) reported on the development of the Index of *Handicapping Labio-lingual Deviation (H.L.D.)* which was designed to identify individuals with handicaps resulting from malocclusion.

* The basis for this index was assessment of only the upper and lower labial segments.
* Cleft lip and/or palate patients and severe traumatic deviations resulted in the child automatically being assessed as handicapped and therefore eligible for treatment. These anomalies received the score of 15.
* Measurements for overjet, overbite, mandibular protrusion, open bite and labio-lingual spread were measured using a Boley gauge.
* The overjet and overbite was measured in the patients in centric occlusion.
* Labio-lingual spread is a term coined by Draker to describe the displacement and/or rotation of individual teeth from an ideal arch form. Only the most severe individual measurement of rotation or displacement was recorded.
* The original index scored 5 for anterior crowding in both the maxilla and mandible and ectopic eruption of the anterior teeth resulted in this being multiplied by 3. On preliminary statistical analysis, these components were found to lack definition and were therefore abandoned. Mandibular protrusion was measured in millimetres and multiplied by 5, with the open bite being multiplied by 4.
* After all components were measured, the H.L.D. score was totalled. A score of 13 and over constituted a physical handicap.
* The inter-examiner reproducibility of this measurement showed complete agreement between examiners in 40 per cent of cases. An agreement of 80 per cent was achieved when the validity was tested against clinical subjective assessments for a total of 272 clinic cases.

The Orthodontic Treatment Priority Index (TPI) developed by **Grainger (1967)** is a method of assessing the severity of the most common types of malocclusion in order to rank individuals according to the severity of their malocclusion, their degree of handicap or priority for treatment.

* The index was based on the qualitative measurement of 10 occlusal traits selected as a means of expressing the degree of handicap or the priority of treatment, 6 conditions should be detectable either through a measurement or because of the obvious severity of the condition. An eleventh item was included for special cases in which measurements seem inappropriate. The rare but severe defects such as cleft palate or other gross dento-facial anomalies would be reported and automatically assigned the highest severity score.

* This index was designed to eliminate the arbitrary nature of earlier indices; it utilised a weighted scale based on data established on a trial population to assign numerical values to the various occlusal disorders.

Salzmann (1967) developed an index, the *Handicapping Malocclusion Assessment Record (HMAR)*, to measure on models the severity of malocclusion relating to dental health, function and aesthetics. A *Supplementary Oral Assessment Record* **(Salzmann 1968)** is used when the assessment is made directly in the mouth of the patient. This index has been widely used in clinical programs. **Allen (1970)** examined 110 children to determine the feasibility of direct mouth examination in completing the *Handicapping Malocclusion Assessment Record.* The result indicated that this was a valid and practical method of using this index. When compared with the *TPI*, the *HMAR* was found to be less reliable **(Albino et al. 1978)**.

Summers (1971) developed the *Occlusal Index*, based on the *Malocclusion Severity Estimate* and the *Treatment Priority Index*, to measure the occlusion for epidemiological purposes.

* The *Occlusal Index* records nine characteristics including dental age, molar relation, overbite, posterior crossbite, posterior openbite, tooth displacement (actual and potential), midline relations, and missing permanent maxillary incisors.

* This index has been tested for validity and intra-examiner reliability. It correlates highly (rs = 0.92) with the clinical standard, indicating high validity. It appears to be valid over time, since average group scores did not decrease. Intra-examiner reliability was very high (rs = 0.96).

* This index needs to be developed as it only measures the occlusion; not aesthetic impairment.

The *Dental Aesthetic Index (DAI)* developed by **Cons, Jenny** and **Kohout (1986)** is an orthodontic index based on socially defined aesthetic standards. It is useful in both epidemiological surveys to identify unmet need for orthodontic treatment, and as a screening device to determine priority for subsidised orthodontic treatment **(Jenny & Cons 1996)**.

Since indices currently in use were criticised as lacking an aesthetic or psychosocial component; *DAI* links the clinical and aesthetic components mathematically to produce a single score that combines the physical and the aesthetic aspects of occlusion. The *DAI* is sensitive to occlusal conditions that have the potential for causing psychological or social dysfunction. After a patient's score has been calculated, it can be placed on a scale to determine the point at which the score will fall between most and least socially acceptable dental appearance. The further a *DAI* score falls from the norm of most socially acceptable dental appearance, the more likely the occlusal conditions is socially and physically handicapping.

Otuyemi (1996) claimed that standardised methods used for assessing need for orthodontic treatment have tended not to separate dental aesthetic impairment from the functional impairment. Currently, orthodontic indices have been developed to assess treatment need based on aesthetic impairment and psychosocial handicap. *DAI* has decision points along the *DAI* scale defining case severity levels that approximate the judgement of orthodontists **(Jenny & Cons 1996)**.

The *Index of Orthodontic Treatment Need (IOTN)* **(Brook & Shaw 1989)** was developed by a team in the University of Manchester and has two components which rank malocclusion in terms of the significance of various occlusal traits for the individual's dental health and perceived aesthetic impairment. The *Dental Health Component* was developed by **Brook** and **Shaw (1989)** and the *Aesthetic Component* of the index was developed by **Evans** and **Shaw (1987)**.

When comparing and contrasting these indices; **Jenny** and **Cons (1996)** claimed that in some ways the *IOTN* and the *DAI* are similar. Both contain aesthetic and clinical criteria and accept the assumption that a significant benefit of orthodontic treatment is improved aesthetics and, by inference, social and psychosocial well-being. Each index aims to identify those children who are most in need for orthodontic treatment subsidised by public funds. Both the *IOTN* and the *DAI*

have two components. The clinical and aesthetic components of the *DAI* link mathematically to produce a single score that combines the clinical and the aesthetic aspects of occlusion.

So and **Tang (1993)** stated that for a population with low dental awareness, it would be very unlikely that a great demand for correction of minor orthodontic problems such as minor to moderate tooth displacement or pre-restorative orthodontic treatment, would exist. Therefore, information on treatment need measured by an index as sensitive as the *IOTN*, has to be interpreted very carefully; the need and the realistic treatment demand of the group can be different.

Otuyemi (1996) in his study, comparing the *DAI* and *SCAN,* revealed that the proportions of patients treated for malocclusion at various severity levels are consistently related using both *DAI* and the *SCAN* index.

The *Standardised Continuum of Aesthetic Need (SCAN)* as developed by **Evans** and **Shaw (1987)**, provides an assessment of dental appearance, which is based on perception of dental appearance. The *SCAN* index has been incorporated as the *Aesthetic Component of the IOTN*. *DAI* identifies certain occlusal features which constitute aesthetic impairment, however it does not record features like dental midline discrepancy, buccal crossbite and openbite. Although buccal crossbite or openbite may be not important from the dental aesthetic point of view, they could affect the need for orthodontic treatment. The basic differences between the *DAI* and *SCAN* are that *DAI* identifies physical occlusal features that the *SCAN* index matches for overall dental appearance on a continuous scale of ten dental photographs.

Malocclusion Studies in Indonesia

Studies on malocclusion in Indonesia have been reported from different parts of the country.

Kuswahyuning (1977) studied 1100 schoolchildren in Yogyakarta using the WHO examination method. She found that the prevalence of malocclusion among these children was around 75%.

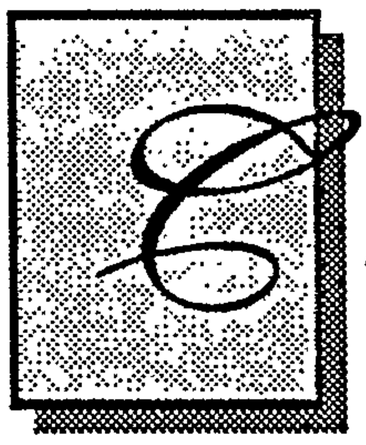
Pambudi (1978) reported that the prevalence of malocclusion among schoolchildren in Surabaya was around 66%.

Johnson et al. (1978) conducted a malocclusion study among 184 randomly selected Javanese children in Surabaya. They found a high prevalence of incisor crowding, bimaxillary prognathism and a class I molar relationship. While crowding was very common, there appeared to be few antero-posterior, vertical or lateral discrepancies.

Djokosalamoen (1983) conducted a comparative study of the malocclusion using study models taken from schoolchildren in Manchester (UK) and Surabaya (Indonesia). He found that the 12 parameters for malocclusion could be used for regrouping the samples from Manchester children, but not for samples from Surabaya. He introduced the "Djokosalamoen Index" that he considered "suitable" for measuring the severity of malocclusion amongst Indonesian children.

Pambudi (1988) interviewed parents of 130 children who visited the orthodontic clinic of Airlangga Dental Faculty in Surabaya to study the motivation of patients for orthodontic treatment. He found that 66% of patients were motivated by the parents because they felt that the dental appearance of their children was not good.

Dewanto (1988) conducted a study on malocclusion in 139 Javanese people from rural and 150 people from urban area of Yogyakarta. She found the prevalence of Class I malocclusion was 64% among these people and no difference was found between the two groups. There was a difference in the main characteristics of malocclusion between rural and urban people and attrition was more prevalent in rural people.



hapter Four

METHOD (32 - 48)

Chapter Four

METHOD

Outline

The information gained from this investigation is expected to be useful for planning the orthodontic services in the future. To achieve the objectives of the study, a systematic method for field study is necessary. To develop this method, it is important to emphasise:

- what information is relevant for representing the demand of orthodontic treatment;
- which data should be collected to identify the need for orthodontic treatment; and
- what kind of analysis could be used to identify factors that influence the need and demand for orthodontic treatment.

Since the study is conducted in East Java where the local situation is typical of developing country conditions with its bureaucratic process and numerous limitations in public facilities, the information that could be obtained is limited and a personal approach to the authorities was indeed necessary before the research could be conducted.

* The investigator needed to go to the survey's location and meet the key person of the areas chosen for the study. In this case it was the Principal of the Primary Schools.

* The interview and questionnaire required adaptation to the local condition that requires a simple question that could be understood by the respondents.

* The questionnaire for the schoolchildren was quite similar to the questionnaire for the parents in order to obtain an objective opinion or perception from both sides.

* Clinical examination was performed by the investigator.

* In urban schools which have dental clinics, the examination took place in the school's clinic but in most rural schools where the dental clinics were not available, the examination was carried out in the classroom where the schoolchildren study.

* In both urban and rural areas, the schoolchildren were seated on a chair facing the window and daylight, as this is considered suitable for this kind of examination in Indonesia.

* The coded data was entered onto dBase IV by a clerical assistant in Surabaya.

* All data entry was completely re-checked by the investigator from the raw data from questionnaires and clinical examinations.

* Data was tabulated and analysed by the investigator in Sydney.

* Statistical assistance for analysis was received from Ms. Doungkamol Sindhusake.

Selection of Method to be Used

Questionnaire

Demand for care, knowledge, perception and attitudes were measured by a set of questions which were completed by the schoolchildren in the classroom. The questionnaire was divided into sections including questions dealing with previous dental treatment and dental attendance, knowledge of dental health and orthodontic treatment. The words used in the questionnaire were those usually used by lay persons.

Self Assessment of the Aesthetic Component

After completing the questionnaire, the schoolchildren were then called one by one to answer a further question which dealt with the self assessment of their Aesthetic Component. Each child was individually called and asked to assess their own teeth appearance compared to a set of 10 standard photographs of Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN) by asking the following question :

"Here is a scale of ten photographs of teeth showing different levels of attractiveness.
Number 1 is considered the most attractive and number 10 is the least attractive.
Where would you put your teeth on this scale?"

1 2 3 4 5 6 7 8 9 10

The answer was recorded in the questionnaire sheet of each schoolchild, and the children were asked to go back to the class again.

To the parents, a questionnaire was sent to obtain comparable information concerning their knowledge, perception and attitudes regarding dental health and malocclusion of their children. A black and white copy of the 10 scaled standard photographs was also included in the envelope. The answers from the parents were sent back to the Principal of the School after 3-5 days. The questions asked of the parents were comparable to the questions asked of the schoolchildren.

Clinical Examination of the Survey

Measuring the Need for Orthodontic Treatment

The next step was the examination for **Dental Health Component (DHC)** and the **Aesthetic Component (AC)** of the **Index of Orthodontic Treatment Need (IOTN)** which was done by the one dentist examiner, the investigator. The criteria for the **IOTN** are given in **Appendix 1.**

The decision to choose the **Index of Orthodontic Treatment Need (IOTN)** for the Survey was based on a number of factors. The *IOTN*, from the University Dental Hospital of Manchester, appeared to be the most appropriate for this study, because it represented a simple, quick and reasonably reproducible method of recording orthodontic treatment need. It is also practical as it can be used in a clinical setting and also for dental study casts. As all the traits are simple to record, it may be possible for less highly personnel to apply the index, following suitable training and calibration, so that it can fulfill most of the ideal requirements as a good index as recommended by **Draker (1960), Summer (1971)** and **Prahl-Andersen (1978).**

This new index was quick to apply, and thus suitable for the large sample selected for this study. The *IOTN* was also easy to learn **(Lunn 1993)** and the investigator had been previously calibrated and trained in Manchester to use this index for this study **(see Appendix 3)** at a time (1991-1992) when the *Index of Orthodontic Treatment Need (IOTN)* had been recently developed in Manchester by **Brook** and **Shaw 1989** and was gaining widespread acceptance by clinicians in the United Kingdom **(Burden & Holmes 1994).**

So and **Tang (1993)** conducted a study to compare the *Occlusal Index (OI)* and the *Index of Orthodontic Treatment Need (IOTN)*; to assess orthodontic treatment needs from the dental casts of 100 dental students in Hongkong. The results showed a weak association between the two indices (Spearman's correlation coefficient = 0.31) but both indices were highly reproducible. Neither *OI* nor the *IOTN* is perfect, but using the *IOTN* is less time consuming, making it easier for a study with a large population, while the *Occlusal Index* was much more time consuming to use. However, the *IOTN* heavily weights tooth displacements, and this may be over sensitive, especially when the index is being used as an epidemiological tool.

The *Dental Health Component* measuring dental health and the *Aesthetic Component* scale maybe a better indicator of an individuals perception of their level of dental attractiveness and occlusion than questioning alone can reveal. When used in conjunction with the *Dental Health Component*, the *Aesthetic Component* may provide valuable insight into guiding the patient for a beneficial decision on the need for orthodontic treatment **(Holmes 1992)**.

For the **Clinical Examination** of the **IOTN**

* The clinical examination took place at schools, in both urban and rural areas. It was carried out in the mornings between 9 - 11 am, after the schoolchildren finished the questionnaire.

* Each child was called individually to the room where the clinical examination was carried out.

* The examiner gave a short explanation about the clinical procedures and the schoolchildren were seated on a chair facing a window. Daylight is considered suitable for this kind of examination in Indonesia.

* To examine the Dental Health Component, **IOTN plastic ruler** and mouth mirrors were used by the examiner for each schoolchild.

* Then, the examiner assessed the schoolchild Aesthetic Component by using a set of 10 scaled coloured standard photographs.

* A cheek retractor was applied, and appearance of the teeth was compared to the AC photographs and results were noted down in the answer sheet by the junior dentist assistant.

* The time taken to record both the dental health and aesthetic components by this experienced examiner was approximately one minute.

* However, if several minor traits required examination to identify the most severe grade allocation, the time taken could be up to 3 minutes.

Development of Method for Field Study

Development of the Questionnaires

To obtain information on the demand of orthodontic treatment, a structured interview questionnaire was first developed. Questions were divided into four sections including :

- questions about past dental treatment and attendance
- questions about dental health knowledge and behaviour
- questions about dental health to assess knowledge
- questions about knowledge of orthodontic treatment

The original design of the questionnaire was a structured interview questionnaire constructed in Manchester, UK by the investigator, after several discussions with the supervisor Mr FJ Hill, Professor AA Blinkhorn and the statistician Mr C Roberts. The process of constructing the original questionnaire was completed in October 1992.

Pilot Testing of the Interview Questionnaire

The questionnaire had been pilot tested in Manchester by Mr FJ Hill using a sample of ten, 12 year old patients who had come to the Paediatric Dental Clinic at Manchester Hospital Dental Clinical School, UK. Mr Hill stated that there were no difficulties encountered in testing the questionnaire on Manchester's children. Each child could understand and answer all the questions without any difficulties. It took only about 8 - 10 minutes to answer all the questions (the first design of the questionnaire is attached in **Appendix 2**).

The questionnaire used in the survey was not the original. It was a translation from English to Indonesian language. In Surabaya, Indonesia, the questionnaire was translated into the Indonesian language by the writer and two colleague dentists from the Department of Dental Public Health, Faculty of Dentistry, University of Airlangga, Dr Adi Hapsoro and Dr Hanindyo Soelarso. The translation of the interview questionnaire was then tested with 30 schoolchildren in an urban school and 28 schoolchildren in a rural school. There were no difficulties encountered in answering the questionnaire by urban schoolchildren, except that the time spent to interview each child was about 30 minutes which was considered too long. In rural schoolchildren the problem was greater because of the local language difficulties and the time spent for interviewing each rural child was much longer at 45 minutes.

After pilot testing the interview questionnaire, it was found that the method of collecting data by interviewing the schoolchildren one by one was too time consuming especially in rural areas. For this reason, it was decided that the questionnaire should be modified into a written format.

Written Questionnaire

The written questionnaire was based on the previous interview questionnaire. In general, all the questions were similar, but the answers were modified into multiple choice questions.

* The written questionnaire was pilot tested again with 50 urban schoolchildren.
* Most of the schoolchildren could finish the questionnaire in 30-35 minutes.
* The questions were still divided into 4 sections covering:
  - past dental treatment and dental attendance;
  - dental health knowledge and behaviour;
  - knowledge of orthodontic treatment; and
  - demand for orthodontic treatment.
* Question 25 (**Q.25**) of the demand section is a special interview question. Each child was individually asked to assess their perception of their own teeth appearance using a series of 10 scaled standard photographs of teeth that indicate good looking teeth appearance and change gradually to least attractive appearance. By this question it was expected that the information of what they perceived of their teeth aesthetic appearance could be obtained.
* The words used in the questionnaire are those usually used by lay persons.
* For the parents, another quite similar questionnaire was used to obtain information concerning their knowledge regarding dental health and the awareness of seeking orthodontic treatment for their children.
* The final questionnaires used (an English translation) are given in **Appendix 2.**
* There were some modifications to the questionnaire after preliminary analysis of responses from the schoolchildren in Survey 1.

Modifications to the Written Questionnaires

There were slight differences between the questionnaires used for Surveys 1 and 2; the words used were not identical but the questions were seeking the same information. There were some unsatisfactory answers to the questionnaire in Survey 1. Some questions were modified, to make them more simple and easier to understand.

Schoolchildren's Questionnaire

The content of the questionnaire used in Suurvey 2 was basically the same as the questionnaire for the first study. The purpose of most changes was also to make it easier to analyse the results. Some changes made in the questions dealt with the arrangement or words used in the questions. For instance: letters in front of the "stem" were changed to number, to make it easier for coding the answer. **Q.2** in Survey 1 questionnaire was changed for Survey 2 to **Q.2, Q.3, Q.4** and **Q.5**

Q.2 I will go to the dentist
a. for routine check up
b. only if I have trouble
c. only if my parents or my teacher order me
d. other

This question was split into **four** separate simple questions

Q.2 Do you go to the dentist only when you have trouble?

1. yes
2. no

Q.3 Do you go to the dentist regularly?
1. yes
2. no

Q.4 If you visit the dentist regularly, what it is for ?
1. check up
2. treatment

Q.5 If you go to the dentist, who request you to do that?
1. parents
2. teacher
3. other

The change was made with the expectation that there would be less possibility of false answers.

In Survey 1, the schoolchildren chose the answer to some questions which they thought would be more in line with examiner expectation; for example, in **Q.2**; 52% of the rural schoolchildren answered that they would go to the dentist for the routine check-up which is usually every six months, while in the next question about the time of the last visit to the dentist only 33% of them had actually visited the dentist in the last six months

Another example is **Q.16** and **Q.15** (**Q.13** and **Q.14** in Survey 1)

Q.16 Do you use toothpaste to brush your teeth?

Q.15 Do you use other things besides toothbrush and toothpaste to brush your teeth?

In Survey 1, **Q.14** came before **Q.13**

Q.13 only asked if they used other things besides **a toothbrush** (not **toothbrush and toothpaste**), this question is not clear enough for the children, because most of them thought that

"other thing" means toothpaste. What the examiner aimed for in this question is another "instrument", for instance the fibre of a coconut with the pumice etc.

Some supplementary questions dealing with orthodontic treatment were also added in Survey 2. These are **Q.26, Q.28, Q.29 and Q.30**

Q.19 and **Q.21** were the same questions. Only answers from question **19** were used in the analysis. Only small differences were found in the answers between **Q.19** and **Q.21** which had been included as a "check" question and was essentially the same as **Q.19.**

Q. 27 I always want to be good looking; this question was not included in **Survey 2.**
It was predicted that almost all of the schoolchildren want to look good, as the answers in Survey 1 were as follows;

	Urban	**Rural**	**Total**
a.yes	838(89%)	801(90%)	1639(89%)
b.no	106(11%)	94(10%)	200(11%)
Total	**944(100%)**	**895(100%)**	**1839(100%)**

	Female	**Male**	**Total**
a.yes	841(91%)	796(87%)	1637(89%)
b.no	82 (8%)	118(13%)	200(11%)
Total	**923(100%)**	**914(100%)**	**1837(100%)**

Almost all schoolchildren in both urban and rural areas **(89%:90%)** always want to be good looking. After final analysis it was found that, this question showed their true feeling regarding "beauty", and their expectation of their facial appearance when compared to the results of other questions of the surveys **(Q1.19;Q2.22;Q2.29)**.

Organisation and Implementation of Survey

Organisation

Before conducting the survey, some written approval needed to be arranged. The process started in November 1992. The letters organised were:

1. A letter from the Head of Department of Orthodontic to the Dean of Faculty of Dentistry, University of Airlangga, to ask permission for the Examiner, as a member of teaching staff to conduct the survey.
2. A letter from the Dean of the Faculty to the President of the University of Airlangga for the permission to carry out the survey.
3. A letter from the Dean of the Faculty with the acknowledgement of the President of the University of Airlangga to Directorate General of Political Affair, Ministry of Internal Affair, Surabaya - East Java, to ask permission to conduct the survey in Surabaya.
4. A letter from the Dean of the Faculty with the acknowledgement of the President of the University of Airlangga to **Department of Education and Culture, Surabaya** - East Java, to ask permission to use schoolchildren as a sample for the study and to get information concerning the schools to be surveyed.

Permission to carry out the survey was approved from these organisations after two weeks.

Place and Time of Study

The place of study was located in the municipality area of Surabaya, the capital city of East Java Province. Surabaya is the second largest city in Indonesia, a seaport with modern living and industrialisation. This area is about 500 kilometres square and has a population of 4.5 million people who live in urban and rural (sub-urban) communities.

The first survey was conducted in February, March and April of 1993 and the second survey was in the period of April, May and June 1994. The raw data collected from the field were analysed within the Discipline of Public Health Dentistry, University of Sydney, Australia in 1995-1997.

Implementation of Survey

* A list of the urban schools classified as "upper-middle" to "high" socioeconomic status and the rural schools categorised as the "lowest" socioeconomic status was acquired from the **Office of Department of Education and Culture (1992)**. Based on this list, the schools to participate in the survey were chosen. There were 15 urban schools and 29 rural schools involved in this study.

* The Department of Education and Culture sent a letter to those schools to explain that the schools had been chosen for a dental survey.

* The examiner visited the Principal of each school to arrange the best time to come to collect the data and to give a brief explanation about the project, examination to be given and the questionnaire to be answered by the schoolchildren.

* On the day of the survey, the examiner was introduced to the teacher of the class by the Principal of the school.

* The examiner gave the explanation to the class of what they were expected to do with the questionnaire and also about the examination with the IOTN.

* In this survey, the examiner was helped by Dr Devi Rianti, a junior teaching staff member from Faculty of Dentistry of Airlangga, with the distribution and collection of the questionnaire and some administrative matters in the survey such as to note down the result of the IOTN, to put the number of the questionnaire sheets in a good order.

* The schoolchildren answered the questionnaires in the classroom.

* The examiner, the assistant and the teacher were present in the classroom, in case there were any questions needed to be clarified.

* The survey was conducted on a single day for most schools. In the urban schools, because of a large number of schoolchildren, the survey might take two to three days in one school.

* The time allocated to complete the questionnaire was 20 minutes, but the urban schoolchildren needed 25-30 minutes to finish while the rural schoolchildren needed a bit longer, 40 minutes, to complete all the questions.

Population Investigated

The target population to be investigated in this study were the schoolchildren with the age of 12 years at the time of investigation, who live in the Surabaya Municipality area.

* They are divided into two different populations, the urban communities who live in the centre of Surabaya city and the rural (suburban) population who live in the peripheral areas of Surabaya.
* Since the Surabaya Municipality has a big area (about 500 square kilometres), the term "rural area" is used for areas with a distance more than 20 kilometres from the city centre and located near the border of other regencies surrounding the city of Surabaya.
* The urban community has its characteristics such as modern lifestyle, good public facilities and they live in a crowded community.
* The rural community has the opposite characteristics, since they do not live in a crowded community, have limited public facilities and most of them live traditionally in the village area.
* A list of the urban and rural areas of Surabaya Municipality is shown in **Appendix 4.**

Sample - Schoolchildren

The sample selected were schoolchildren from the elementary schools identified from the list of 1035 schools (656 urban and 379 rural schools) from the Department of Education and Culture.

* The schools were stratified into two groups as urban and rural schools.
* Using stratified cluster random sampling, 15 urban and 29 rural schools were identified.
* All of the schoolchildren with the age of 12 years from these schools were involved in the study. It was expected that at this age the schoolchildren might have an understanding if there is something wrong with their appearance, especially a matter dealing with the teeth.
* The first data collection was conducted in February 1993 with 2067 schoolchildren, 1128 urban and 939 rural from 15 urban and 29 rural schools in Surabaya.
* The questionnaire was divided into four sections (27 questions), dealing with dental experience, knowledge of dental health, knowledge of orthodontic treatment and perception of malocclusion.
* The second data collections were conducted one year later, involving 349 urban and 337 rural schoolchildren of the same age (12 years old) and their parents.
* The second questionnaire was divided into four sections (31 questions), similar to the first survey but included four additional questions dealing with orthodontic knowledge **(Appendix 2).**
* Overall, 1477 urban and 1276 rural schoolchildren were involved for the two surveys.

Sample - Parents

A random subsample of 686 parents (349 urban and 337 rural) of the schoolchildren involved in the second survey was selected and either the father or the mother answered the questions.

* The questionnaire for the parents has a section about the occupation of the father which is categorised into "high rank" and the "low rank" occupations as follows :

High rank occupation :- merchant
- medical doctor, dentist, veterinarian, lecturer, lawyer
- high rank officer in army and government employee
- contractor, banker, tax officer
- other occupations that could be considered as the same level.

Low rank occupation :- labourer, daily worker, driver
- owner of small stallshop, kiosk or traditional shop in local market
- farmer, fisherman, animal husbandry employee
- trishaw (becak) or public transport driver
- low rank officer in the army or government employee
- other occupations that could be considered as the same level.

Ethnic Classification

The ethnic origin of the subject is classified whether they belong to **Javanese, Chinese, Same-Race ethnic** and **Other-Mixed ethnic** group.

* The subject is classified as "Javanese" if both of the parents came from a Javanese ethnic background as well as their grandparents.

* Similarly, the subject is classified as "Chinese" if both of the parents came from a Chinese ethnic background as well as their grandparents.

* Subjects would be classified as the "Same Race" ethnic if they are not considered to be Javanese or Chinese, but come from the other ethnic groups like Sundanese, Madurese, Ambonese or the Batak ethnic background.

* "Other-Mixed" ethnic group were subjects come from the mixed parents and grandparents ethnic background; they are mixed between ethnic groups and do not belong to one pure ethnic group. When a reasonable assumption can not be made, subjects are grouped as "Other-Mixed".

Method of Analysis

The data obtained from the questionnaires was transferred to computer dBase file and analysed statistically using the **Statistical Package for Social Science (SPSS)** system.

* The Chi-square method is used for analysing differences between two groups of samples based on locality (urban and rural), by gender (male and female) or by occupation (high and low).
* The Spearman's rank correlation method is used to analyse the agreement between the **Dental Health Component** and **Aesthetic Component** of the **Index of Orthodontic Treatment Need.**
* The differences of the **Aesthetic Component** assessment by the dentist, schoolchildren and their parents are analysed using the Wilcoxon signed-rank test.

The Index of Orthodontic Treatment Need (IOTN)

To measure the need for orthodontic treatment, the **Index of Orthodontic Treatment Need (IOTN)** was used in this study **(Appendix 1).** This index aims to rank malocclusion in terms of the significance of various occlusal traits for an individual's dental health and perceived aesthetic impairment, with the intention of identifying those individuals who would be most likely to benefit from orthodontic treatment. The Index incorporates a **Dental Health Component (DHC)** and an **Aesthetic Component (AC).**

The Dental Health Component (DHC)

The Dental Health Component **(DHC)** was developed by **Brook** and **Shaw (1989).**

* This index was roughly modelled on the Index of the Swedish Dental Board **(Linder-Aronson 1974).** The Swedish index was meant as a basic guide, and its practical implementation called for a "good sense of judgement".
* The **DHC** was developed to reduce this subjectivity in measurement.
* It also records the various occlusal traits of malocclusion which would increase the morbidity of the dentition and surrounding structures **(Brook & Shaw 1989).**
* It has five grades, grade 1 represents a small or negligible need for treatment while grade 5 indicates a great need for treatment.
* In use, various features or traits of malocclusion are recorded. Cleft Palate, severe overjets greater than 9mm would fall into grade 5. Displacements between contact points less than 1mm would fall into grade 1. However, only the highest scoring traits need to be recorded.

* The grades were grouped to indicate priority for treatment, as follows:

Grade 1 - 2	:	No / Little need for treatment
Grade 3	:	Borderline treatment need
Grade 4 - 5	:	Need for treatment

* A ruler has been designed containing all the information necessary to record the Dental Health Component. The ruler has been developed for the clinical setting by which information is collected regarding competence of the lips, displacement on closure and masticatory or speech problems.
* There are two ways of recording the DHC. The first is to record the grade only. The second method provides more information regarding the prevalence of the individual occlusal traits. For example, an overjet greater than 9 mm. would be graded as 5a (the grade being 5 and the overjet signified by letter a).
* See **Appendix 1** for total coding of the **DHC.**

The Aesthetic Component (AC)

The Aesthetic Component was developed by **Evans** and **Shaw (1987)** and this component consists of ten scaled colour photographs showing different levels of dental attractiveness.

* The dental attractiveness of prospective patients can be rated with reference to this scale.
* When applied in the clinical setting, the patient's lips are retracted with self-retaining lip retractors and a rating allocated.
* Black and white photographs are used for dental cast assessments. When applied to study models, the casts are examined in occlusion from the front and the appearance of the dentition judged as it would be seen in normal day to day interaction.
* Monochrome photographs and dental casts have an advantage in that raters are not influenced by oral hygiene, gingival conditions or poor colour matches in restorations affecting anterior teeth **(Woolass & Shaw 1987).**
* Grade 1 represents the most attractive tooth arrangement while grade 10 is the least attractive arrangement of teeth.
* The score reflects the aesthetic impairment, and by inference reflects the sociopsychological need for orthodontic treatment.

Grade 1 - 4	:	No / Slight need for treatment
Grade 5 - 7	:	Borderline treatment need
Grade 8 - 10	:	Need for treatment

Examiner Calibration

To make similar qualified judgements in using the IOTN system, the examiner who performed the clinical examinations had been trained and calibrated at Turner Dental School, the University Dental Hospital of Manchester, University of Manchester, United Kingdom with other dentists **(Appendix 3)**. Study models and slides were used in this calibration exercise.

* The examiner was also trained for using the index by examining about 60 schoolchildren 12 years of age from "Wigan" Public School, Greater Manchester, United Kingdom with Dr Richmond.

Validity and Reproducibility of the Index of Orthodontic Treatment Need

Validation

In order to assess the extent to which the indices reflect current British orthodontic opinion, a validation exercise was carried out.

* A panel of 74 dentists was enlisted, comprising 22 consultant orthodontists, 22 specialist orthodontic practitioners, 11 community dental officers, 15 general dental practitioners, and four other advisors from the Dental Practice Board and Junior orthodontic hospital staff.
* Each panel member recorded a personal opinion on the need for orthodontic treatment and the change due to the treatment of 234 start and finish study casts using standardised rating scales.
* Sixteen cases were duplicated to allow double determination.
* The models were then independently scored with the Index of Orthodontic Treatment Need (IOTN) by the investigating team.
* The panel and the investigator scores were statistically examined and compared.
* The panel were extremely divided as to what constituted treatment need for dental health, with very low levels of agreement between judges and even within judges.
* Despite this, the correlation between the Dental Health Component of IOTN and the collective view of the panel was reasonably high, although agreement between the panel for the Aesthetic Component of the IOTN was higher **(Shaw et al. 1991c)**.

Reproducibility

* In general, the reproducibility of the Dental Health Component of the IOTN was good in ideal clinic settings.

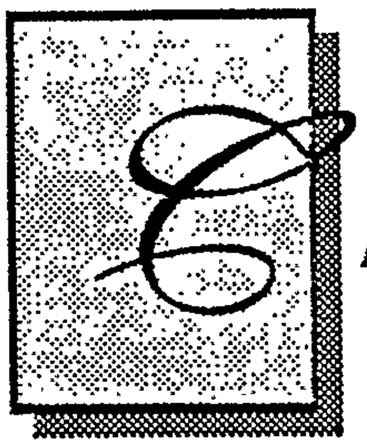
* Less than ideal conditions, as in a school setting, resulted in somewhat poorer reproducibility.

* For the Aesthetic Component, good inter-examiner and intra-examiner reproducibility is accomplished, when a dentist rated a child for aesthetic impairment **(Brook & Shaw 1989).**

* However, **Holmes (1992)** looking at self-evaluation of dental aesthetics by children found only slight agreement with the examiner aesthetic judgement. There was a tendency for children to over-rate their level of attractiveness compared with the professional assessment.

* Using the Kappa statistic, inter-examiner agreement of four examiners who were trained and calibrated, in the use for the Index of Orthodontic Treatment Need; showed almost perfect agreement for the Dental Health Component (Kappa coefficient = 0.83) and substantial agreement for the Aesthetic Component (Kappa coefficient = 0.72). **(Shaw et al. 1991c).**

* The investigator did not participate in this reproducibility exercise.



hapter Five

RESULTS (49 - 104)

Chapter Five

RESULTS

The results of the study were divided into three sections according to the sample composition.

1. The whole survey

The whole survey included all the schoolchildren from Survey 1 and Survey 2, and the parents of the schoolchildren who were involved with the second survey. A total of 1,477 urban and 1,276 rural schoolchildren were involved in this survey with 349 and 337 parent respondents, respectively. The results in relation to each question were considered by locality, gender and ethnic group as well as the parents' responses. The ethnic groups consisted of the four major sub-populations, i.e., Javanese, Chinese, Other Groups and Mixed Groups. The whole sample consisted of 12 year old children attending the schools surveyed at the time of data collection. The investigator carried out clinical examinations for each of the schoolchildren in Survey 1 and Survey 2 using the Index of Orthodontic Treatment Need (IOTN)

2. Survey 1

The first data collection in March 1993 included 2,067 schoolchildren aged 12 years old: 1,128 urban and 939 rural schoolchildren; comprised of 1034 female and 1031 male schoolchildren. In this survey, 54 schools were involved, and these were divided into 15 urban and 39 rural schools. The target population was the 12 year old schoolchildren in Surabaya city and the rural (suburban) areas surrounding Surabaya. The questionnaire for Survey 1 consisted of 27 questions divided into four sections, dealing with dental experience, knowledge of dental health, knowledge of orthodontic treatment and perception of malocclusion. At the end of the questionnaire one additional interview question was answered regarding the subject's self-assessment. Each child was individually called and asked to assess their own teeth appearance compared to a set of 10 standard photographs of Aesthetic Component (AC) of the Index of Orthodontic Treatment Need (IOTN).

3. Survey 2

Nine months after the first survey, a second survey was conducted. The population was similar

(the next class) to Survey 1 with the addition of parent respondents. It comprised 349 urban and 337 rural schoolchildren from 6 of the urban and 15 of the rural schools and their parents. This survey questionnaire consisted of 31 questions and was also divided into the four sections, dealing with dental experience, knowledge of dental health, knowledge of orthodontic treatment and perception of the malocclusion. At the end of the questionnaire one additional interview question was answered regarding the subject's self-assessment. A similar questionnaire was sent home to the parents with a black and white set of photographs for them to assess the Aesthetic Component of the child.

Distribution of Sample

In this chapter, results in table format will be presented as numbers and percentage based on the answers to the questionnaires and findings of the clinical examination.

Table 1 Number of survey sample, by locality

Locality	Survey 1	Survey 2	(Parent)	Total
Urban	1128	349	(345)	1477
Rural	939	337	(334)	1276
Whole survey	2067	686	(679)*	2753

* only 7 parents did not respond

Table 2 Distribution of gender (schoolchildren), by survey

Gender	Female	Male	Total
Survey 1	1034	1031	2065*
Survey 2	345	341	686
Total	1379	1372	2751*

* missing observations = 2

Table 3 Distribution of ethnic groups, by survey

Ethnic groups	Survey 1	Survey 2	Total
Javanese (JJ)	1168 - 56%	489 - 71%	1657 - 60%
Chinese (CC)	632 - 31%	128 - 19%	760 - 28%
Same Race (SR)	32 - 2%	19 - 3%	51 - 2%
Other - Mixed	235 - 11%	50 - 7%	285 - 10%
Total	2067 - 100%	686 - 100%	2753 - 100%

Survey One - Results of the Questionnaire (schoolchildren)

Sample size : 2067 schoolchildren (Survey 1).

Section One: Questions about Dental Attendance and Past Dental Treatment

Question 1: Have you ever been to the dentist ?

Results from Question 1 from Survey 1 are seen in **Table 1.1**

Table 1.1 Dental attendance, by locality

Dental attendance	Urban	Rural	Total
Yes	1062 - 95%	406 - 44%	1468 - 72%
No	61 - 5%	518 - 56%	579 - 28%
Total	1123 - 100%	924 - 100%	2047* - 100%

* 20 observations missing = no response from 5 Urban and 15 Rural.

Question 2: I will go to the dentist for ..... (reasons) ?

Table 1.2 Reason to go to the dentist, by locality

Reason	Urban	Rural	Total
Routine check-up	**297 - 27%**	**222 - 52%**	**519 - 35%**
If having trouble	**541 - 50%**	**179 - 42%**	**720 - 48%**
Told by parents/teachers	**127 - 12%**	**11 - 3%**	**138 - 9%**
Other reason	**108 - 10%**	**15 - 3%**	**123 - 8%**
Total	**1073 - 100%**	**427 - 100%**	**1500 - 100%**

Note: 1468 said they had ever been to the dentist but the actual figure may be closer to 1500

Question 3: When did you last go to see the dentist ?

Table 1.3 Time since last visit to dentist, by locality

Last visit to dentist	Urban	Rural	Total
6 months ago	**292 - 29%**	**143 - 33%**	**435 - 30%**
Year ago	**288 - 28%**	**83 - 20%**	**371 - 26%**
1-2 years ago	**88 - 9%**	**53 - 12%**	**141 - 10%**
More than 2 years	**339 - 34%**	**152 - 35%**	**491 - 34%**
Total	**1007 - 100%**	**431 - 100%**	**1438 - 100%**

Question 4: Do you go to a. Private dentist b. Public Health Centre dentist c. School dentist d. Dental Hospital e. Others

Table 1.4 Type of dentist visited, by locality

Type of dentist	Urban	Rural	Total
Private	798 - 74%	54 - 13%	852 - 57%
Public health centre	76 - 7%	243 - 57%	319 - 21%
School dentist	57 - 5%	18 - 4%	75 - 5%
Dental hospital	75 -7%	96 - 22%	171 - 11%
Others	73 - 7%	18 - 4%	91 - 6 %
Total	1079 - 100%	429 - 100%	1508 - 100%

Question 5: Have you had any teeth filled ?

Table 1.5 Experience of tooth filling, by locality

Filling	Urban	Rural	Total
Yes	763 - 71%	148 - 35%	911 - 60%
No	290 - 27%	251 - 58%	541 - 36%
Don't know	27 - 2%	30 - 7%	57 - 4%
Total	1080 - 100%	429 - 100%	1509 - 100%

Question 6: Have you had any teeth taken out ?

Table 1.6 Experience of tooth extraction, by locality

Extraction	Urban	Rural	Total
Yes	763 - 71%	148 - 35%	911 - 60%
No	290 - 27%	251 - 58%	541 - 36%
Don't know	27 - 2%	30 - 7%	57 - 4%
Total	1080 - 100%	429 - 100%	1509 - 100%

Question 7: Who has taken out your teeth ?

Table 1.7 Person who did tooth extraction, by locality

Tooth extraction by	Urban	Rural	Total
Medical doctor	69 - 7%	8 - 2%	77 - 6%
Dentist	786 - 83%	369 - 92%	1155 - 86%
Nurse	10 - 1%	9 - 2%	19 - 1%
Other	81 - 9%	15 - 4%	96 - 7%
Total	946 - 100%	401 - 100%	1347 - 100%

Question 8: Why did you have your teeth taken out ?

Table 1.8 Reason for tooth extraction, by locality

Reason for extraction	Urban	Rural	Total
Caries/decay	379 - 39%	218 - 55%	597 - 44%
Ortho treatment	305 - 32%	98 - 24%	403 - 30%
Other reasons	186 - 19%	23 - 6%	209 - 15%
Don't know	96 - 10%	60 - 15%	156 - 11%
Total	966 - 100%	399 - 100%	1365 - 100%

Section Two : Questions about Dental Health Knowledge and Behaviour

Question 9: I have been given advice regarding oral health care from .....

Table 1.9 Source of dental health information, by locality

Information source	Urban	Rural	Total
Teacher	148 - 14%	129 - 14%	277 - 14%
Dentist	516 - 47%	593 - 64%	1109 - 54%
Parents	335 - 30%	157 - 17%	492 - 24%
Books	62 - 6%	31 - 3%	93 - 5%
Other	36 - 3%	22 - 2%	58 - 3%
Combinations	-	-	-
Total	1097 - 100%	932 - 100%	2029 - 100%

Question 10: How often do you clean your teeth ?

Table 1.10 Frequency of toothbrushing, by locality

Frequency	Urban	Rural	Total
Twice a day	878 - 80%	793 -85%	1671 - 82%
Once a day	133 - 12%	105 - 11%	238 - 12%
Once a week	7 - 1%	10 - 1%	17 - 1%
Never	4 - 0.4%	4 - 0.4%	8 - 0.4%
Other frequency	83 - 8 %	17 - 2%	100 - 5%
Total	1105 - 100%	929 - 100%	2034 - 100%

Question 11: The proper time to brush / clean the teeth is .....

Table 1.11 Proper time for toothbrushing, by locality

Proper time brushing teeth	Urban	Rural	Total
After breakfast & dinner	747 - 67%	640 - 69%	1387 - 68%
Before breakfast & go to bed	197 - 17%	248 - 27%	445 - 22%
Time is not important	39 - 4%	18 - 2%	57 - 3%
Others	125 - 11%	25 - 3%	150 - 7%
Total	1108 - 100%	931 - 100%	2039 - 100%

Question 12: Do you have your own (brush) toothbrush ?

Table 1.12 Have their own toothbrush, by locality

Have toothbrush	Urban	Rural	Total
Yes	1066 - 95%	764 - 82%	1830 - 89%
No	58 - 5%	173 - 18%	231 - 11%
Total	1124 - 100%	937 - 100%	2061 - 100%

Question 13: Do you use other things besides toothbrush to clean your teeth?

Table 1.13 Use other things to clean teeth, by locality

Use other cleaning	Urban	Rural	Total
Yes	200 - 18%	108 - 12%	308 - 15%
No	921 - 82%	815 - 88%	1736 - 85%
Total	1121 - 100%	923 - 100%	2044 - 100%

Question 14: Do you use toothpaste to brush / clean your teeth ?

Table 1.14 Use of toothpaste, by locality

Use toothpaste	Urban	Rural	Total
Yes	1102 - 99%	732 - 87%	1834 - 94%
Not always	8 - 1%	65 - 8%	73 - 4%
Never	1 - 0.1%	49 - 5%	50 -2%
Total	1111 - 100%	846 - 100%	1957 - 100%

Question 15: Do you have a dental clinic at your school ?

Table 1.15 Availability of dental clinic at school, by locality

School dental clinic	Urban	Rural	Total
Yes	1022 - 92%	519 - 57%	1541 - 76%
No	95 - 8%	400 - 43%	495 - 24%
Total	1117 - 100%	919 - 100%	2036 - 100%