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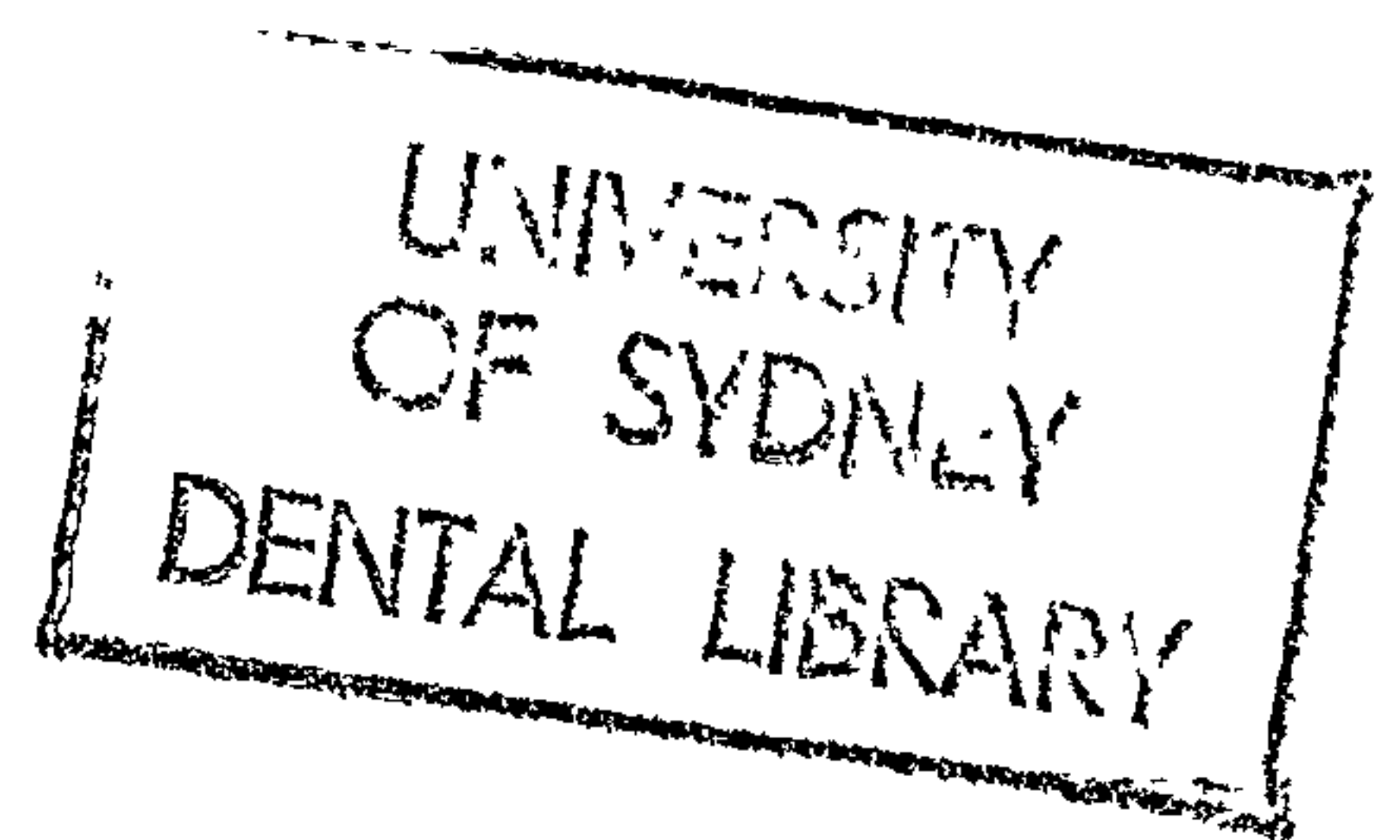
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PERIODONTAL DISEASE - EPIDEMIOLOGY

A REVIEW OF THE LITERATURE AS AN AID TO

HEALTH PLANNING IN INDONESIA



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A Thesis submitted in partial requirement
for the
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D e d i c a t i o n t o

my wife Isdiatun Moelyosoemardono

and

my daughter Any Setyawati

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CONTENTS

Page

<u>ACKNOWLEDGEMENTS</u>	..	..	..	..	i
<u>CHAPTER 1</u>	<u>INTRODUCTION</u>	..	..	..	1
<u>CHAPTER 2</u>	<u>PERIODONTIUM</u>	..	..	..	6
2.1	The Gingiva	..	..	..	6
2.2	The Periodontal Ligament	..	..	..	8
2.3	The Cementum	..	..	..	8
2.4	The Alveolar Bone	..	..	..	8
<u>CHAPTER 3</u>	<u>EPIDEMIOLOGY</u>	..	..	..	10
3.1	General	..	..	..	10
3.1.1	History	..	..	..	11
3.1.2	Scientific Method in Epidemiology	..	..	..	12
3.1.2.1	Formulation of the Hypothesis	..	..	..	13
3.1.2.2	Design of the Investigation	..	..	..	13
3.1.2.3	Selection of the Sample	..	..	..	14
3.1.2.4	Conduct of the Examination	..	..	..	14
3.1.2.5	Analysis of the Data	..	..	..	15
3.1.2.6/7	Drawing the Conclusions/ Publishing the Results	..	..	..	15
3.2	Epidemiology in Periodontal Disease	..	..	..	16
3.2.1	Correlation of Periodontal Disease with Age	..	..	..	18
3.2.2	Influences of Sex	..	..	..	19

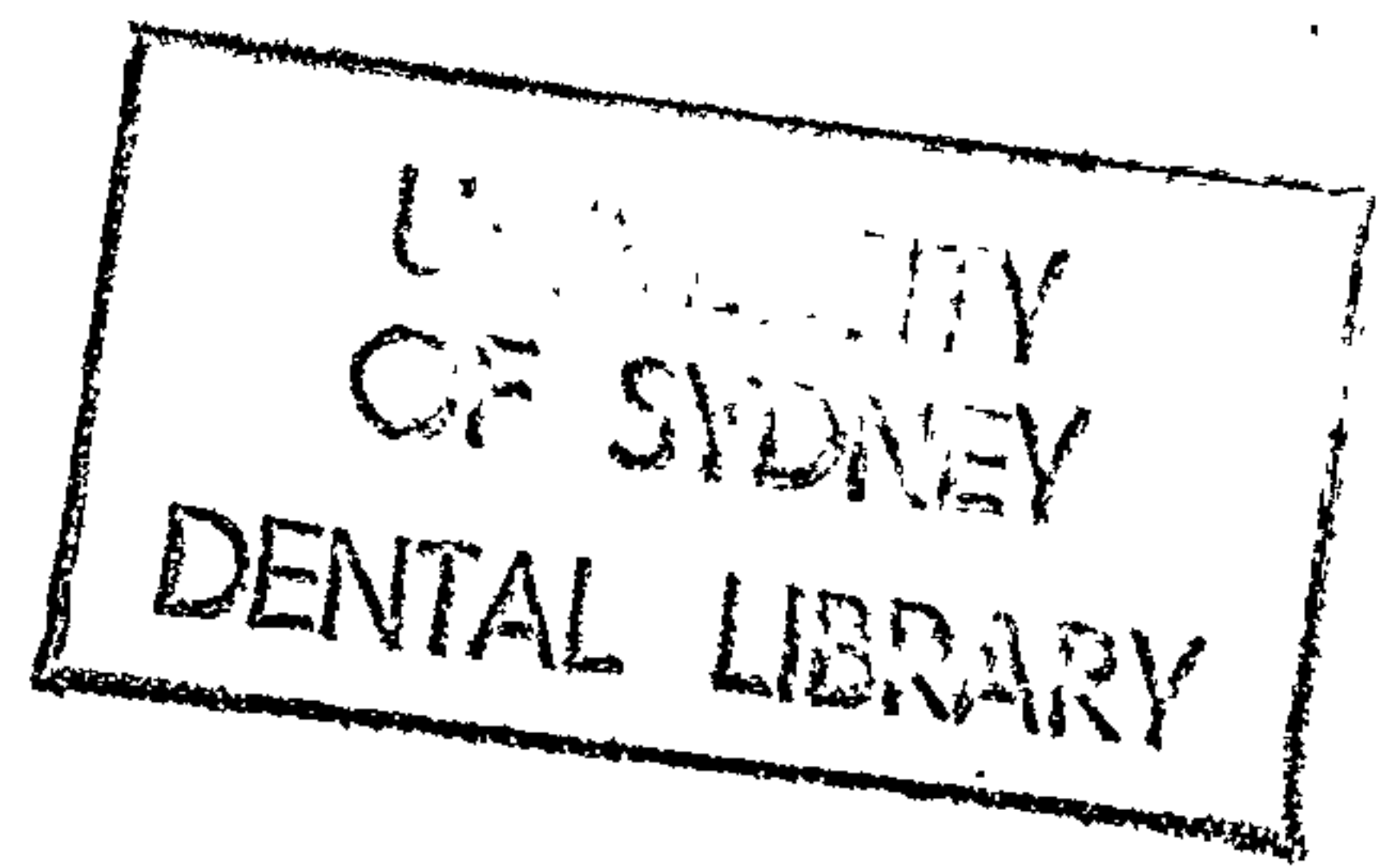
3.2.3	Correlation with Oral Hygiene	..	21
3.2.4	Effect of Prophylaxis in addition to improved Oral Hygiene	..	23
3.2.5	Association with Socio-economic Status	..	23
3.2.6	Effect of Tobacco ..	..	24
3.2.7	Effect of Betel ..	..	25
3.2.8	Correlation with General Disease ..	..	26
3.2.9	Correlation with Nutritional Factors ..	..	26
3.2.10	Correlation with Dental Caries ..	..	30
3.2.11	Correlation with Fluoride Concentration in the Drinking Water	..	30
3.2.12	Correlation with Malocclusion ..	..	31
3.2.13	Association with Traumatic Occlusion	..	32
3.2.14	Correlation with Prosthetic Restorations	..	35
3.2.15	Geographic Distribution of Periodontal Disease ..	..	35
3.2.16	Effect of Race	..	36
3.2.17	Conclusions	..	37
<u>CHAPTER 4</u>	<u>PERIODONTAL DISEASE - INDICES</u>	..	39
4.1	Irreversible Indices	..	41
4.1.1	Bone Loss Index ..	..	42
4.1.2	Gingival Recession Index ..	..	44
4.2	Reversible Indices	..	45
4.2.1	Gingival Indices ..	..	45

Page

4.2.1.1	The P-M-A Index	..	45
4.2.1.2	The Gingival Index	..	47
4.2.2	Periodontal Index	.. ..	48
4.2.3	The Plaque Index	.. ..	52
4.2.4	The Retention Index	.. ..	53
4.3	Composite Indices	.. ..	53
4.3.1	Periodontal Disease Index	..	54
4.3.2	Gingival Bone Count	.. ..	57
4.3.3	Periodontal Disease Rate	..	58
4.4	Oral Hygiene Indices	.. ..	59
4.4.1	Oral Hygiene Index - OHI	..	60
4.5	Need for Periodontal Treatment, Costs in Delivering Necessary Treatment	..	62
4.5.1	The Periodontal Treatment Need System - PTNS	.. ..	66
<u>CHAPTER 5</u>	<u>ORAL HEALTH PROBLEMS IN INDONESIA</u>		70
5.1	Introduction	.. ..	70
5.2	General Health Conditions	.. ..	72
5.3	Dental Education	.. ..	72
5.4	Oral and Dental Health Conditions	..	74
5.5	Preventive Dentistry	.. ..	83
<u>CHAPTER 6</u>	<u>PREVENTION OF PERIODONTAL DISEASE</u>		87
6.1	Prevention by Dentists and their Auxiliaries	.. ..	89
6.2	Prevention by Individual	.. ..	94

<u>CHAPTER 7</u>	<u>SUMMARY</u>	..	..	..	98
------------------	----------------	----	----	----	----

<u>REFERENCES</u>		..	..	..	102
-------------------	--	----	----	----	-----



CHAPTER I

INTRODUCTION

The World Health Organisation in its 1961 report on periodontal disease stated: "Periodontal disease is one of the most widespread diseases of mankind. No nation and no area of the world is free from it and in most it has a high prevalence, affecting in some degree approximately half the child population and almost the entire adult population.

Research and clinical evidence indicate that the damage caused to the supporting structures of the teeth by periodontal disease in early adult life is irreparable, whilst in middle adult life it destroys a large part of the natural dentition and deprives many people of all their teeth long before old age. The total effect of periodontal disease on the general health of populations is unassessable."

There could not be a more positive statement regarding the ramifications of this disease and because of its universal distribution is a problem best handled through a public health approach. Before any public or community health based programme can be planned or instituted, epidemiological surveys of the concerned population must be undertaken.

Periodontal disease is an inexact term used to designate a variety of conditions of the supporting structures of the teeth. It is ordinarily referred to by laymen as "pyorrhea" and is an ancient disease of men.

Alveolar bone loss was prevalent in the jaws of Egyptian mummies 4000 years ago. Iceland skulls dating from A.D. 874-980 have been found which display various stages of periodontal disease.⁸⁷

The history of ancient India goes back some three or four thousand years before Christ. Hindus cleaned their teeth very carefully with a toothbrush known as "Dantakashtha"; it consisted of twigs or small branches of various aromatic shrubs frayed at the end. Powders and pastes were used with them. Tooth ache was thought to be brought about by a tooth worm which gnawed away the dental tissues and caused dental caries (Krimi-danta). Removal of

tartar, extraction of teeth and treating Upakusa (periodontal disease) were some of the activities performed by the dental surgeon in ancient India.

It is of interest to note that many rural communities in Indonesia still believe in the so-called "worm theory" as the cause of dental caries. That is they believe that a "worm" is present within the tooth and it eats away the tooth structure thus causing a cavity to form. In such communities, until education becomes more available, it is advisable to enlist the aid of the traditional leaders and opinion formers, such as witch-doctors, in getting over health education messages.

The native Chinese practitioners, 2700 B.C., applied a specific therapeutic method for the treatment of various diseases including those of the dental tissues. The procedure was known as acupuncture.

Dentistry made big advances in the Middle Ages. In 1050-1122 Abulquasim who is regarded as the greatest Arabian surgeon of the Middle Ages designed a set of scalers for removing tartar which he thought was the cause of gum disease.⁸⁷

Pierre Fauchard (1678-1761) in 1728 published his epoch-making book, The Surgeon Dentist, which constituted

the first systematic attempt to present a complete picture of the practice of dentistry. He is known as the "Father of Modern Dentistry."⁸⁷

In modern times, in 1907, the term "parodontium" was introduced by Wiesner. He called the parodontium the ensemble of anatomic and functional structures consisting of the alveolar process, pericementum, and gingiva within the region of a tooth.⁸⁷

In the nuclear age of the twentieth century the term periodontium is used to describe the connective tissue which supports and invests the tooth as well as the entities mentioned in the preceding paragraph. The periodontium consists of alveolar process, periodontal ligament, cementum and gingiva.

The development, acceptance and widespread use of the DMF index as a measure of dental caries incidence and prevalence have led to comparable attempts to quantify periodontal disease. Because of its wide range of pathogenicity and associated clinical manifestations, assessment or measurement of periodontal disease presents many difficulties. In the past it had been difficult to study because of the necessity for subjective measurement of the conditions with the resulting wide variations

between observers and the difficulty in standardizing examination techniques and methods of diagnosis. Within the past twenty years indices for measuring periodontal disease have been refined and made more objective both in regard to the amount and severity of the disease. There are now being developed new indices which provide a more accurate picture of treatment needs and costs involved, to assist in programme planning.⁵⁸

In developing countries, such as Indonesia, there is a shortage of resources which affects priorities in regard to the amount available for either preventive or curative services in the general oral health service. However, some resources must be made available for carrying out initial epidemiological surveys in order to assess both treatment needs and demands in the community so that a balance can be struck between preventive and necessary curative services.

The aim of this Thesis is to review the literature of the epidemiology of periodontal disease, in order to gain some perspectives for control and preventive measures in Indonesia. The author believes it will be useful both for the Faculty of Dentistry of The Gadjah Mada University, Yogyakarta, and for the Indonesian Department of Dental Health.

CHAPTER 2

PERIODONTIUM

Epidemiologic methods, as in the other health fields, are expected to contribute to knowledge about the etiology of periodontal disease so as to assist in its treatment, control and hopefully its ultimate prevention. Since consideration of periodontal disease must necessarily relate to the periodontium, the following is a brief description of that structure which is essentially composed of the gingiva, the periodontal ligament, the cementum of the tooth surfaces and the alveolar bone (alveolar process):^{45,47}

2.1 The gingiva is composed from epithelium and connective tissues. The epithelium is of the stratified squamous type and that lining both the free and the attached gingiva is keratinised except for that part which is in contact with the tooth surface (the pocket or crevicular, epithelium).

The normal gingiva is coral pink but may present areas of pigmentation depending on race, and is firm and

resilient. It is divided into the marginal, attached and interdental gingiva.

The marginal (free or unattached) gingiva is the unattached gingiva surrounding the teeth in collar-like fashion and demarcated from the adjacent attached gingiva by a shallow linear depression, the free gingival groove. The unkeratinised epithelial lining of the free gingiva and the surface of the tooth form the boundaries of the gingival sulcus which normally varies in depth from 0-2 mm.

The attached gingiva is continuous with the marginal gingiva. It is firm, resilient and tightly bound to the underlying cementum and alveolar bone. The facial aspect of the attached gingiva extends to the relatively loose and movable alveolar mucosa from which it is demarcated by the mucogingival line. The interdental gingiva occupies the gingival embrasure which is the interproximal space beneath the area of tooth contact. It consists of two papillae, one facial and one lingual. In the absence of proximal tooth contact, the gingiva is firmly bound over the interdental bone and forms a smooth rounded surface without papillae.

2.2 The periodontal ligament is the connective tissue structure situated between the cementum, covering the roots of the teeth, and the alveolar bone. It is continuous with the connective tissue of the gingiva and communicates through vascular channels in the bone with the marrow spaces. The main functions of the periodontal ligament is to transmit the occlusal forces upon the teeth to the alveolar bone and to act as a cushion to the impact of these forces.

2.3 The cementum is the calcified mesenchymal tissue which covers the anatomic root of the teeth. The major function of the cementum is to secure an anchorage of the teeth. The attachment is provided by collagen fibres from the periodontal ligament which, in the form of Sharpey's fibres are embedded into the cementum.

2.4 The alveolar bone is that portion of the maxilla and mandible that forms the sockets of the teeth. It consists of the two boundary plates of cortical bone between which there is a network of cancellous bone. This network is filled in by bone marrow, blood vessels and nerve fibres. Into the bone plate, which lines the dental alveolus, numerous bundles of collagen fibres from the periodontal ligament are inserted. These are referred

to as Sharpey's fibres and an area of bone containing a greater number of Sharpey's fibres is called "bundle bone".

CHAPTER 3

EPIDEMIOLOGY

3.1 General

The word "epidemiology" is derived from the Greek "epi" - upon, "demos" - the people, and "logos" - discourse or science. It was originally confined to the origins, development and distribution of communicable disease or epidemic infections, but today has a wider and more literal meaning.

It can be defined as "the orderly study of diseases and other conditions in human populations where the group rather than the individual is the unit of interest."

The objects of epidemiology are twofold: The investigation of disease and other conditions in populations to ascertain the public health needs and to conduct research into the factors that may influence the occurrence of the disease or conditions with a view to their ultimate prevention or control.⁶¹

Epidemiology is a tool in the research of disease etiology and other threats to health. Data obtained from such research may enable the clinician or public health worker to direct preventive or controlling measures and treatment against those factors which are known to be of public health significance. It is not so much the study of disease as a process, as it is a study of the conditions of the people in whom disease occurs.

Accordingly, the purposes for which epidemiological investigations are carried out may be summarised under five headings, although a single investigation may in fact serve more than one objective.⁶

1. Provision of data necessary for planning and evaluating health care and health care delivery systems.
2. Identification of determinants of disease so as to enable prevention.
3. Evaluation of methods used to control disease.
4. Observation of the natural history of disease.
5. Classification of disease.

3.1.1 History

The history of epidemiology cannot be separated from that of medicine especially up to the nineteenth century.

Man's belief about the cause of epidemics has undergone radical change through the ages. Disease and epidemics were originally attributed to supernatural causes and it was not until the work of Louis Pasteur (1822-1895) and Robert Koch (1843-1910) that the germ theory was accepted. In the mid-seventeenth century, a London physician, Thomas Sydenham stressed the importance of careful clinical observation and wrote the histories not of sick persons but the history of disease and thus became the founder of epidemiology as we know it today.

3.1.2 Scientific Method in Epidemiology

Epidemiology involves the application of scientific methods to the study of health and disease in population groups.²⁸ An epidemiological investigation should follow a logical scientific pattern, of which the following is an example:⁶¹

1. Formulation of the hypothesis.
2. Design of the investigation.
3. Selection of the sample.
4. Conduct of the examination.
5. Analysis of the data.
6. Drawing the conclusions.
7. Publishing the results.

3.1.2.1 Formulation of the hypothesis

The investigator should be absolutely clear about the objects of the investigation before he considers its design, as the latter is entirely dependent upon the former. The starting point of a study is frequently the expression of a "null hypothesis": that is the assumption that there is no difference in the extent of dental disease between the groups to be investigated, or, in the circumstances of a clinical trial, that one method is no better than another in preventing or treating a disease or condition. The object of the investigation will be to test this hypothesis.²⁸

3.1.2.2 Design of the investigation

Types of study. There are two main subdivisions of epidemiology. The first is known as the "prevalence study", also called point-prevalance or cross-sectional study where the occurrence of a disease or condition in a population is expressed at a given point in time. Prevalence studies are commonly used for making comparisons between two or more populations or between the same population at different times.

The second type is the "incidence" or longitudinal study, where the amount of new disease in a population is

measured over a period of time. This is usually expressed as the proportion of that population which becomes affected per unit of time.

3.1.2.3 Selection of the sample

When designing a study it is usually impossible to examine every individual in the population or "universe" under investigation. Resources are usually not available. A small number of individuals or "sample" must be chosen from the population. A technique which will provide more valid data is to take a "random" sample from the population. For a sample to be truly random each individual must have an equal chance of being included in the sample.

3.1.2.4 Conduct of the examination

For the scientific epidemiological study of dental disease and condition, three aspects are of great importance: the examination methods and diagnostic aids, the diagnostic criteria, and the indices used for measurement and reporting. It is recommended that the World Health Organisation Manual entitled "Oral Health Surveys: Basic Methods" be consulted prior to all dental epidemiological studies. It sets out simple procedural, and diagnostic systems, which, if adopted, would allow comparison of studies all over the world.

Before any disease or condition can be studied, it is necessary to decide on well-defined criteria for its diagnosis and classification. These criteria should be as simple as possible and they should be standardised and reproducible;¹³ other examiners using the same criteria should diagnose the condition in the same way and the same examiner should diagnose the condition in the same way on another occasion.

3.1.2.5 Analysis of data

The main consideration when dealing with epidemiological data is their inherent variability. The first requirement of analysis is to determine whether the difference is a true difference and not an accidental result of sampling error. These determinations are estimates based upon statistical analysis.^{13,14}

3.1.2.6/7 Drawing the conclusions and publishing the results

Care must be taken that the conclusions are specifically related to the investigation that has been carried out and that no extrapolation is made to the population as a whole unless the investigation was designed accordingly.

The presentation of the report is, within certain limits, a matter of personal style, but a conventional pattern is as follows:

Introduction. Review of literature. Reasons for conducting the present investigation. Objects of the present investigation and the hypothesis to be tested.

Materials and methods. This deals with the selection and description of the samples and the methods used in diagnosis, together with diagnostic criteria. The whole method and technique of the investigation should be set out clearly.

Results. These should be tabulated and illustrated as appropriate, with relevant amplification in the text.

Discussion and conclusions. The investigation, its findings and its conclusions are discussed at the discretion of the author.

3.2 Epidemiology in Periodontal Disease

Since the World Health Organisation has stated that periodontal disease and caries are large scale public health problems, it is obvious that epidemiological surveys of these diseases need to be carried out. Much work has been done, particularly in developed countries,

in surveying these two oral diseases. More work needs to be done, particularly in developing countries, in order that preventive and control programmes can be developed to fully and efficiently use their limited resources both of finance and all manpower.

Periodontal disease per se does not usually cause discomfort before entering into the terminal stages; its public health significance lies in its ultimate consequences, the tooth mortality. When deviation from absolute health is used as criterion, it is often useless to compare prevalence of periodontal disease in different populations as the prevalence will be close to 100 per cent in the good ones as well as in the bad ones.

In the evaluation of the public health significance of periodontal disease, severity as well as prevalence must be considered; and with that idea in mind, the modern indices have been developed.

Periodontal disease in some form or other is ubiquitous, but its severity varies widely from continent to continent, from country to country and (within the same country) from community to community; furthermore, within the same community there may be variations in severity associated with age, sex, socio-economic factors and a multitude of other conditions. In the following, the

factors which are known to condition periodontal disease will be evaluated.¹²⁹

3.2.1 Correlation of Periodontal Disease with Age

In all surveys in which severity has been taken into account, periodontal disease has been found to progress steadily throughout life.^{4,19,20,23,52,56,71,77,79,97,100,109,110,111,114,124,126,115}

Gingivitis is common in the primary dentition of most children, and it may even develop into frank periodontitis in some cases.^{8,70,86,114} However, periodontal disease has no fatal consequences in the primary dentition, except in rare cases of unusually low resistance due to known or unknown systemic factors.

Due to the fluctuating and unfavorable local conditions during the period of mixed dentition,⁵⁵ the gingival health of the permanent teeth is difficult to evaluate during that period. In the teen-age, the prevalence of gingivitis increases with the increasing age, and the first periodontal pockets can be observed early in this period.^{86,106A,110}

Although true periodontal pockets can be observed around some teeth in some children before age 13,^{106A} periodontitis does not often lead to tooth mortality

before age 20, and even between 20 and 30 the number is small.^{23,37}

From age 13 and upwards the proportion of persons with periodontal pockets increases,^{14,55,104} and so does the number of teeth with bone loss.⁵⁵ The breakdown of the periodontal structures goes on in a close linear fashion from age 13 throughout life.¹⁰⁰ The average bone resorption will reach a plateau at about age 40-50, because extraction after that period continuously will bring out of the calculation the most severely involved teeth.⁵⁹

The strong correlation between periodontal destruction and age suggests, at first glance, that age per se is an etiologic factor. The explanation is most likely that periodontitis is a cumulative process and that the linear increase with age reflects this feature.⁹⁷ This is a very important observation as too many dentists, and even periodontists, take it for granted that old people are less resistant to periodontal disease than are young ones.

3.2.2 Influence of Sex

In practically all surveys carried out in the U.S.A. and Europe, the periodontal conditions are found to be significantly better in females than in males.^{23,54,71,76,101}

This may look surprising in view of the fact that the female sex hormones, in some way or other, influence the gingival conditions during puberty,²³ pregnancy and menopause.^{3,17,18,42,64,65,102} When the status of oral hygiene is compared in the two sexes, females are found to be considerably better than males,¹¹¹ and when comparisons are made between males and females of the same age and oral hygiene status, no difference is found between them.^{71,117} This sex difference in favour of the females may be taken as representative of the conditions in the well developed countries.⁵⁴

In the less developed countries the sex difference seems to be absent,^{49,55} or reversed,¹²⁴ i.e., the periodontal conditions are worse in females than in males, at least after age 20.¹²⁶ Even when males and females of the same oral hygiene status are compared, the females have more periodontal disease. The most plausible explanation of this discrepancy is that females in developing countries give birth to a child nearly every year, and that the frequent pregnancies and lactation periods drain the mother of nutrients; in addition, in most developing countries a large proportion of the population lives on a substandard nutrition.⁹⁵ It is not surprising that these conditions are reflected in a reduced resistance to

local irritants. During pregnancy the gingivitis scores increase with a peak in its latest part.^{3,17,18,65,66,67} There is also a marked increase in pocket depth.^{17,18,64,65} Both these characteristics return to normal values after parturition, apparently without leaving any irreversible damage.^{17,18,65,66,67}

3.2.3 Correlation with Oral Hygiene

Regardless of whether gingivitis, periodontitis, or bone destruction is measured, there is strong correlation between the severity of these conditions and oral hygiene.^{23,79} This association comes particularly well out when an oral hygiene index is used.^{20,65,66,71,79,95,97,100,106A} Provided that the sample is sufficiently large the correlation between PI (periodontal index) and OHI (oral hygiene index) is very close to a linear one,²⁹ and only age shows an equally strong correlation.²⁵

A statistically significant correlation between two conditions gives in itself no clue to which one is the cause and which one is the effect. Thus, there are still people who argue that periodontitis causes the formation of plaque and calculus. The definite evidence to the opposite has been demonstrated in a number of clinical

trials in which periodontal disease was shown to decrease was directly proportioned to the improvement of oral hygiene.^{19,51,62,66,75,76}

For most clinicians the cause and effect relationship between plaque and periodontal inflammation is quite obvious,⁷ and based on data from more than 21,000 people from all corners of the world. An epidemiologist⁸⁷ makes the following statement: "Less than 10 per cent of the variance in group PI scores remain to be explained after the combined influence of age and mouth cleanliness has been estimated. A residual factor wholly independent of age or hygiene, therefore, can have little effect on periodontal disease."

The demonstration of a consistent cause and effect relationship between plaque and calculus versus periodontal disease has provided a solid foundation for prevention and treatment.⁸⁶ Furthermore, in evaluating the effect of various etiologic factors, comparisons between groups or populations should only be made in subgroups having the same oral hygiene and age. By doing so, it became clear that the higher prevalence of periodontitis in males than in females in Western countries was the result of difference in oral hygiene rather than an effect of sex per se.^{71,97,100}

3.2.4 Effect of Prophylaxis in addition to improved Oral Hygiene

Prophylaxis and improvement of oral hygiene may decrease the average mobility as much as 25 per cent.¹⁰⁴ Subgingival scaling and controlled oral hygiene over a five-year period in 800 patients reduced gingivitis to about one-tenth in the group that can co-operate well, and to about one-third in those who co-operated reasonably well. Another trial of the same category showed improvement in P-M scores from 1.6 to 0.6.¹⁰⁴

All these studies support the concept of a bacterial etiology of periodontal disease and they indicate public health measures to its prevention.

3.2.5 Association with Socio-economic Status

Several surveys have demonstrated that the periodontal conditions improve as the years of formal education increases^{71,86,92,94,100,110,117,124} and as the income goes up.^{5,71,110,117,124} Further, people from urban areas have less gingivitis and periodontitis than those living in rural districts.^{5,106A}

In the well developed countries, where even the low income groups can afford to have an adequate diet, the abovementioned differences can be attributed to a

difference in oral hygiene status and dental care;^{73,100} the former is by far the most important one. People with high income and education clean their teeth as an average better than those with low income and education, and people living in the rural districts have, as an average, lower income and less education than those living in urban areas.

The appreciation of these simple facts may be of value to the public health worker when he plans how to improve periodontal conditions on a community basis.

In developing countries where many poor people live on the borderline of malnutrition or starvation, these conditions are also responsible for the higher prevalence of periodontitis.

3.2.6 Effect of Tobacco

The effect of tobacco is consistent and convincing.⁸⁸ Particularly dramatic is the high prevalence of ulcerated gingivitis in young cigarette smokers,⁸⁸ but also simple gingivitis as well as periodontitis with bone resorption increase with increasing tobacco consumption.^{62,88,118,126} "Solely by means of statistical data it has been shown that tobacco has an effect, per se, on the gingival tissues."⁸⁸ In cases where the oral hygiene is good, the

effect of tobacco is reduced considerably.⁶⁰

Although the studies of tobacco are consistent, few of them suggest that the damage belongs to the very serious category. Thus, the available facts do not carry sufficient weight to motivate a person to stop smoking, the more so as tobacco has many similarities with narcotics. However, the observation that the effect of tobacco is minimal in cases where the oral hygiene is good¹¹⁸ may be used in the motivation of the patient to improve the oral hygiene as a compensation for smoking.⁶²

3.2.7 Effect of Betel

Betel is the leaf of a tropical tree. In this is packed the areca nut (the most important constituent), some tobacco, various spices and lime. This package is put into the mucobuccal fold, and some persons consume as many as 30 of them per day. Betel is consumed by most Eastern people, and due to the fact that some two-thirds of the world's population live in betel-consuming countries, its role in the etiology of periodontal disease is of the greatest interest. In a survey¹²⁶ comprising about 8,000 persons, it was found that betel consumers had much more periodontal disease than non-consumers,⁴⁹ and the effect seemed to be clearly stronger

than that of tobacco. When betel chewers and non-betel chewers of the same oral hygiene status were compared, no difference was observed in those with good oral hygiene,⁶⁰ but in the groups with poor oral hygiene, the betel chewers scored much higher. Although the correlation between betel consumption and periodontal status is fairly safely established,⁴⁹ it is still open to question what causes the ill effect. Betel consumption may be one of the important factors responsible for the higher incidence of periodontal disease in the Asiatic countries,¹² and the observation indicates that a reduction of betel consumption would improve periodontal health. However, a campaign to this end would most likely at present be a complete failure.

3.2.8 Correlation with General Disease

More data must be collected before a definite idea can be formed concerning the possible role of general disease in the etiology of periodontitis. Only the unfavourable influence of diabetes seems to be unequivocally established.^{15,21,48} As far as other diseases are concerned, the observations are controversial.⁴² The effect of psychiatric disturbances is uncertain. In some studies a positive correlation has been observed, whereas in others no correlation was found.

In conclusion it may be said that epidemiological investigations have failed to corroborate a widely held opinion stemming from the early days of periodontology that general diseases and psychiatric disorders predisposes to periodontal disease. This again raises the question: Is it justified routinely to look into anemias of every patient? The purpose of such examination obviously is to find clues which may be useful in the treatment. When no such clue has, as yet, been found (except for diabetes) it appears as if such a routine is a waste of time.

3.2.9 Correlation with Nutritional Factors

Reliable statistical data regarding the effect of nutrition on periodontal health are scarce. Particularly, the effect of the various vitamins has been in the focus of interest, and for a long time was taken for granted that they played a very important role. The result obtained in the various surveys are somewhat contradictory, but none of them support the assumption that any of the vitamins are very important.^{42,98}

As far as vitamin A is concerned, there is no evidence that for all practical purposes it is involved in the etiology of periodontal disease. At least two surveys carried out in the Far East^{97,126} (where vitamin A

deficiency is common), and one survey in Africa, failed to demonstrate any effect of this vitamin.^{97,126}

In the case of vitamin B deficiencies, the findings are not consistent. In some surveys, in which highly developed biochemical tests were used to assess the urinary levels of thiamin and riboflavin, no correlation was found between these levels and the status of periodontal health.⁹⁷ In another study¹²⁶ the presence and absence of vitamin B deficiency was diagnosed clinically. Persons showing such signs had as an average higher periodontal disease scores than the rest. This proved to be the case even when oral hygiene was kept constant. However, it must be admitted that a clinical diagnosis of vitamin B deficiency is not based on unequivocal criteria. On the other hand, it is very likely that a vitamin B deficiency may ease the development of periodontitis.¹²⁶

Whatever the final answer will be in this issue, vitamin B deficiency cannot be an important etiologic factor, even in the less developed countries, and in the well developed countries, where such frank deficiencies are very rare, vitamin B deficiency is probably of no public health importance in the case of periodontal disease.

Elaborate studies in which the plasma levels of ascorbic acid⁹⁷ was correlated with the PI scores failed to demonstrate any association. One clinical trial suggests a very slight improvement after vitamin C therapy. Ever since the early days of research in vitamin C deficiency, this condition has been postulated to be an important etiologic factor in periodontal disease. And logically, ascorbic acid has been extensively used in the therapy, alone or in combination with other methods. None of the reasonably well controlled surveys support these viewpoints. Thus, although the intake of vitamin C should not be neglected, it should be appreciated that its role in the etiology of periodontal disease most likely is a fairly unimportant one, and logically, that its routine use in the therapy probably is of little, if any, effect.

Other vitamins than the aforementioned ones have not been considered.

The adequacy of a diet is not dependent on the vitamins alone, but also on proteins, fatty acids and minerals. There are no statistics in which the influence of these factors on periodontal health have been evaluated.²⁵ As a working hypothesis it may be postulated that such a correlation exists and that some of the reasons for the

very high prevalence of periodontal disease in the East is due to malnutrition.^{95,126}

In summary it may be stated: nutritional disturbances are not from a public health point of view involved in the etiology of periodontal disease in the well developed countries; improvement of nutrition in such countries will, most likely, not lead to a corresponding improvement of periodontal health. In the less developed countries such an improvement might be expected.

3.2.10 Correlation with Dental Caries

There is positive association between DMF scores for caries and scores for gingivitis and periodontitis,¹⁰⁹ although the degree of correlation may vary considerably. In view of the fact that caries and periodontal disease have a common etiologic factor, i.e., the plaque, this correlation is easily explained. Once again, research data fail to substantiate commonly held opinion, i.e., that there is an inverse correlation between these two dental diseases.

3.2.11 Correlation with Fluoride Concentration in the Drinking Water

The factual data on this point are small but fairly consistent and show that periodontal health improves as the

fluoride intake increases.^{8,70} One of many arguments against fluoridation of drinking water is that gingival health deteriorates under the effect of fluoride. However, no statistics to this effect have apparently been documented.^{8,36,63,93}

3.2.12 Correlation with Malocclusion

Malocclusion is difficult to characterise in a numerical way,^{4,38} and so far no fully acceptable index has been developed. Data accumulated up to the present time indicate that there is some correlation between periodontal disease and some criteria of malocclusion,^{50,105} and that the most important factor in malocclusion is crowding of teeth.^{4,41} The effect of overjet and overbite is not so consistent.^{4,40} In some studies no correlation was seen.^{4,37,39}

It is easy to understand that crowding may lead to more gingival inflammation, as crowding facilitates accumulation of bacterial plaque. Thus, orthodontic treatment on such grounds is well justified. However, the orthodontic correction of deep bites carried out on the assumption that this treatment will prevent or reduce periodontal disease in the future is hardly justified on basic facts. This must not be taken to mean that ortho-

dontic treatment of such cases should not be carried out; it just means that the motivation must be another one.

3.2.13 Association with Traumatic Occlusion

Assessment of traumatic articulation meets with severe difficulties as there is no agreement as to the criteria of trauma.⁹¹ Stillman's clefts, McCall's festoons, increased mobility, various types of bone resorption, increased width of periodontal space, increased thickness of lamina dura, premature contacts have all, in one or the other combination, been taken as criteria of traumatic articulation.⁴⁶ However, these clinical manifestations are all, at the same time, symptoms of periodontal disease of bacterial etiology.

The mixing of causes and symptoms has obscured this subject for decades, and that is probably one of the reasons why so little work has been done to clarify the association between "traumatic articulation" and periodontal disease.

The few investigations which have been published give little, if any, support to the commonly held assumption that heavy function is directly associated with gingivitis, pocket formation and bone destruction. In one study⁷² the material was divided into two main groups:

(1) one having eight teeth or less, and (2) one having more than eight in contact during occlusion and chewing. This dichotomy was created under the assumption that the same amount of muscle force would cause more overload in the first category than in the second one. There was significantly higher mobility in group 1 than in group 2, but there was no difference in bone resorption.

As bruxism¹²⁰ is usually taken to be synonymous with traumatic articulation, this habit was correlated with the periodontal conditions in one study.¹⁶ No association was found.

Splints, fixed or removable, are extensively used in the therapy of periodontitis. In two very well controlled clinical trials,¹⁰⁴ the effect of removable splints on mobility was investigated. Instead of reducing mobility, splinting led to increased mobility as compared with patients who received ordinary local hygienic treatment.

In the pioneer days of traumatic articulation grinding to attain contact on the balancing side was advocated, the justification being that this would distribute the masticatory forces. Recently, a positive correlation was observed between balancing contact and pocket depth, mobility and bone loss. By first glance this may suggest a "possible role of non-working side contacts in periodontal

disease". A more likely explanation is that severe periodontal inflammation associated with pocket formation and increased mobility leads to migration and extrusion of teeth; in the molar region this will lead to balancing contacts which are uncommon in healthy dentition of adults.

From the analysis of the available data the evidence in favour of traumatic articulation as an etiologic factor in periodontal disease is very weak and the evidence against such as an influence is fairly consistent.^{16,72,104} All the surveys on this subject have their weak points and they can easily be criticised. However, until a reasonably strong correlation between "traumatic articulation" and periodontal disease has been documented, it appears as if the justification of occlusal equilibration and splinting in the therapy is very weak. It may even be questioned whether such therapy should be listed under periodontal therapy. This does not necessarily mean that grinding and splinting are not justified in certain cases; it just requires that the reason for doing so must be some other than preventing and curing gingivitis and periodontal pockets.

3.2.14 Correlation with Prosthetic Restorations

Several reports have shown that gingival inflammation, mobility and bone destruction increase drastically in teeth adjacent to partial dentures.^{21,22,30,123} This is another warning against using partial dentures and removable splints in periodontal therapy. The question may even be raised whether partial dentures in many cases do not cause more harm than good, and it suggests that partial dentures should only be made when the patient for aesthetic or functional reasons cannot be without them.

3.2.15 Geographic Distribution of Periodontal Disease

Differences of geographic distribution of periodontal disease can only be estimated when the same researcher or the same research group carry out the examination in the various places. The studies suited for comparison are, therefore, limited, but the findings are consistent on most points: periodontal disease is much more prevalent and much more severe in some Asian²⁴ and African countries⁸⁰ than in U.S.A.^{23,49} Some South American countries¹¹⁷ seem to fall in between these two extremes.³⁴

What has been said about U.S.A. and Asia also seems to hold true for one Scandinavian country and one Asian country.¹²⁶

There are no data that allow direct comparison between U.S.A. and the different European countries, but there is some evidence that conditions in the Scandinavian countries are not too very far from those in U.S.A.^{23,71}

3.2.16 Effect of Race

The extreme difference in prevalence and severity of periodontal conditions in Asia^{109,126} and Africa⁸⁶ on one side and U.S.A.^{31,110} and Scandinavia on the other side suggests at first glance that a racial predisposition may be responsible for it.^{12,14,49,60,79,117,124,126} Such a difference also exists between negroes and whites in U.S.A.^{100,101} However, when education, professional dental care and oral hygiene were kept equal, no clear-cut difference was observed.^{73,100} Comparisons between populations of the same age in Norway⁶⁰ and Ceylon,¹²⁶ both living on satisfactory nutrition, showed that the difference between the two (PI 0.80 and 1.14) could be attributed to the poorer oral hygiene in the Ceylonese group. Thus, there is no evidence that pure racial factors are responsible for the difference between East and West.²⁰ Most of the differences are due to variation in oral hygiene;²⁰ and in addition adequate intake of calories and essential nutrients as well as betel chewing will probably account for most of

the rest. The importance of the two latter factors is still uncertain.

3.2.17 Conclusions

The analysis of world-wide surveys shows that periodontal disease in some form or other is present in practically all persons, but the severity varies widely. The loss of teeth through periodontal disease causes problems both for individual patients and for health services.

Caries and periodontal disease cause about the same number of extractions in developed countries, whereas in developing countries periodontal disease is the most destructive dental disease and should be given due consideration by health administrators.

Prevalence and severity of periodontal disease have been correlated with a number of conditions, of which age and oral hygiene account for approximately 90 per cent of the variation. Unequivocal association were also found in the sex, socio-economic factors, tobacco and betel consumption, but most, if not all, of these variations can be accounted for by a variation in oral hygiene.

The associations with generalised diseases, nutritional disturbances and malocclusion are not very strong ones.

In the therapy of periodontal disease the main efforts should be directed toward those factors, which are known to have pathogenetic importance, but it should be acknowledged that not all of the latter factors can be changed to the better with this philosophy in mind; it can be appreciated that bacterial plaque and calculus range way above any of the other factors, both because of their fairly linear correlation with periodontal disease and because they both can be removed. That this working hypothesis is correct is evidenced by a number of clinical trials which have shown that gingivitis can be reduced to the same extent as the plaque and calculus is reduced.

Most of the other factors which are shown to have association with periodontal disease cannot be changed at all (age, sex, diabetes, and nutrition in the less developed countries); this precludes any kind of casual treatment.

Epidemiology has already furnished the periodontal profession with valuable information, but it is still a science in rapid development. Therefore, associations which are obscure today may be clarified in the near future.

CHAPTER 4

PERIODONTAL DISEASE - INDICES

Indices for assessing the prevalence and incidence of periodontal disease in the past have varied from recording simple deviations from what was regarded as clinically normal, to some measurement of advanced lesions only, which have inflicted gross damage to the tissues involved. This fact should not be too surprising nor should it indicate, in any way, that the measuring devices have necessarily been defective. Perhaps it is more indicative of the fact that the wide range of pathogenicity of the disease exhibits a wide range of clinical manifestations.

At the proceedings of the World Workshop in Periodontics, 1966, comments,¹²⁹ to some extent the variability in severity of periodontal disease can be brought out by counting the number of inflamed periodontal units or quarter units (buccal, lingual, mesial, distal);⁷¹ severity may also be indicated by some arbitrary descriptive terms as mild, moderate or severe; and the extent of the destruction can be demonstrated by a figure for the bone

loss as estimated in roentgenograms.^{24,26,121} Indices for assessing periodontal disease have been developed into several groups such as: Indices for the measurement of gingival inflammation;⁵³ indices for the measurement of hard deposits;¹²⁵ indices for the measurement of soft accumulations;⁸² and indices for measurement of tooth mobility.⁸⁵ All indices are to be used in epidemiological surveys and further studies in clinical trial.

For the purpose of comparison studies among the world populations for the prevalence of periodontal disease, the World Health Organisation recommend indices that are simple, accurate, highly reproducible so that interstudy comparisons can be made that will be more meaningful.¹ These indices are the Russell Periodontal Index, the Oral Hygiene Index-Simplified, developed by Greene and Vermillion.¹³⁰

All of these approaches may in certain conditions give satisfactory results, but a more precise indication of severity would be desirable in most cases. Further, the data collected should be easily analysed by modern statistical methods.²⁹

The essence of all indices is to classify the periodontal status of a person or population with a single figure which takes into consideration prevalence as well as severity of the condition. Within these limits the

indices may vary considerably. There are reversible, irreversible and composite indices and the criteria of disease vary widely from one index to another. As mentioned earlier (p. 5), in very recent times there are being developed indices to classify need for periodontal treatment and costs of delivering treatment to population groups. To summarise, the main purposes of developing indices to assess periodontal disease are:

1. to assess point prevalence of the disease;
2. to determine incidence of the disease;
3. to assess the severity of the disease.
4. to serve as a basis for evaluation of the role of various etiological factors in the pathogenesis of the disease;
5. to allow an estimate of needs for treatment in the population and its cost;
6. to estimate future requirements of resources;
7. to evaluate methods used to control the disease.

4.1 Irreversible Indices

The most typical feature of an irreversible index is that it assesses the damage caused by the disease rather than the disease itself. That is it estimates total

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1. The first step is to identify the problem or question that needs to be addressed. This involves understanding the context and the specific requirements of the task.

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..... 1.

1. The first condition is that the system must be in a state of equilibrium. This means that the system must be at rest and not moving.

tissue damage over the life-time of the individual and is a measure of the cumulative effects of chronic destructive disease, although the disease can be arrested. The two main irreversible indices are:

4.1.1 Bone loss index of Day and Shourie.^{23,24}

This index, plus others,^{26,121} measures alveolar bone loss by roentgenographs and shows the irreversible damage caused by gingivitis and periodontitis. They return exactly the same figure regardless of whether the bone loss is associated with present severe inflammation or with healthy gingiva (possibly due to successful treatment).

In most X-ray indices normal conditions are postulated to exist when the alveolar bone reaches to about one millimetre or closer, to the cemento-enamel junction.¹¹⁰ The estimation of the amount of bone loss from this arbitrary base line has been done in several ways. The proportion of bone less (in tenths) may be estimated on visual inspections, without the aid of a measuring device. A more accurate estimate of the amount of bone loss can be attained by using a translucent ruler which is placed on top of the radiograph; by this device the length of the root is divided into 10 equal areas and the height of remaining bone or the bone loss can be estimated to the nearest tenth:

- 0 - no bone loss
- 1 - denotes early detectable resorption
- 5 - indicates loss of half the alveolar bone support
- 10 - denotes complete loss of supporting bone as far as the root apex.

Although the measuring can be done fairly accurately with this method, it still has shortcomings which are inherent in all X-ray examinations: a great many interdental spaces cannot be measured because of overlapping teeth; due to variation in the bone level (particularly in the molar region) it may be difficult to decide to what level the bone has been broken down; angulation during exposure may change the estimates considerably.

The weaknesses of the X-ray method are: does not take into account the presence or absence of active disease which could lead to a misleading picture of treatment needs and prognosis; not suited for longitudinal studies due to the fact that bone resorption is a slow process and difficulty of keeping an experiment group together over a long period of time; it is time consuming, requires heavy equipment and is thus expensive.

4.1.2 Gingival Recession Index of Stahl and

Morris.^{23,115} Recession of the gingival

margin to the extent that the cementum is exposed is associated with bone loss. This is the philosophy behind the gingival recession index.¹¹⁵ The percentage of teeth in which the cemento-enamel junction is exposed is computed and the figure is presented as the score of the individual. This method has two main advantages: it is quick; calibration is easy.

However, it has several disadvantages: many cases of severe gingival inflammation, extensive pocket formation and bone resorption show no gingival recession; large numbers of cases with healthy gingiva, optimum bone level interproximally may well show some gingival recession due to vigorous tooth brushing; recession is rare before age 20.

Therefore, it appears that this index is not suited for use in young populations with good oral hygiene; however, in primitive people or in populations where the gingival conditions are not influenced by tooth brushing this index may be of some use.

4.2 Reversible Indices

As the name implies, these indices can return to zero when the disease, which they have measured, for some reason or other, disappears. They assess active disease as contrasted to the irreversible indices which assess the permanent damage caused by active disease.

One class of these morbidity indices is exclusively concerned with the clinical signs of active gingival inflammation (gingivitis indices). Another class takes into account also the destructiveness of the condition by giving more or less weight to pocket deepening and bone resorption.

4.2.1 Gingival Indices

4.2.1.1 The P-M-A index was one of the earliest indices for assessing gingivitis^{77,78} and was devised by Schour and Massler in 1947.¹¹⁶ Each tooth has three related gingival areas: the papilla mesial to it (P), the labial or buccal gingival margin (M), and the attached gingiva (A). The presence or absence of gingival inflammation is recorded in each tooth area and arbitrary ratings of gingivitis prevalence are made for each subject according to the number of areas affected. From clinical

experience it was postulated that periodontal disease starts in the interdental papilla (P), spreads to the marginal area (M) and continues to the attached gingiva in severe cases (A). Thus, the location of the inflammatory process may to some extent indicate the severity of the condition.

A number of workers have modified this index⁷⁸ and introduced severity ratings for the degree of gingivitis found in each area and the areas themselves have been subject to modification.⁹⁰

This index has several short-comings: calibration is difficult; it is questionable whether an overt gingivitis deserves a weight which is four times that of a mild gingivitis, it may well be that the mild one is associated with extensive bone destruction.

There is a large defect in all gingivitis indices; they have no provision for the destructive phases. Periodontitis is a destructive process which progresses steadily throughout life, but measured with a gingivitis index the highest values are often reported during puberty because hormonal imbalance makes the inflammation more overt at that period.

4.2.1.2 The Gingival Index (G.I.) as developed by Loe and Silness^{65,68} is based on the same principles as the P-M-A index. The severity of the conditions is indicated on a scale running from 0 through 3 and each mesial, distal, buccal and lingual gingival unit is scored independently for one molar, one premolar and one incisor in each jaw. For clinical trials this index is very sensitive, has demonstrated satisfactory reproducibility and there is good agreement with the Periodontal Index. It has also been used in combination with a Plaque Index and a Retention Index.⁶⁸

Criteria for the Gingiva Index System:

- 0 - absence of inflammation.
- 1 - mild inflammation - slight change in colour and
little change in texture.
- 2 - moderate inflammation - moderate glazing, redness,
oedema and hypertrophy, bleeding
on pressure.
- 3 - severe inflammation - marked redness and hypertrophy,
tendency to spontaneous bleeding,
ulceration.

Gingiva at six teeth, representing the six segments of the jaws are examined:

The maxillary right first molar
The maxillary right lateral incisor
The maxillary left first bicuspid
The mandibular left first molar
The mandibular left lateral incisor
The mandibular right first bicuspid.

Each gingival unit (buccal, lingual, mesial and distal) of the individual tooth is given a score from 0-3 called the G.I. for the area. The scores from the four areas of the tooth are added, divided by four to give mean, and is the G.I. for the tooth.

The scores of the individual teeth (incisors, premolars and molars) may be grouped to designate the G.I. for the group of teeth.

By adding the indices for the teeth, dividing by six the G.I. for the patient is obtained.

Assessment of the score is as follows:

0.1 to 1.0 - mild inflammation
1.1 to 2.0 - moderate inflammation
2.1 to 3.0 - signifies severe inflammation.

4.2.2 Periodontal Index (PI)

Since Russell introduced his Periodontal Index in 1956,¹⁰¹ it has been widely used throughout the world.

It is a valuable index in surveying an adult population as it takes into account the extent of the destructive consequence of gingival inflammation. It assigns a numerical value to the severity and extent of gingival inflammation and places a value on the level of periodontal destruction.

Numerical values for the periodontal status are greater than those assigned to gingival conditions, providing an index number which increases with the severity of periodontal disease. Russell also¹⁰³ has illustrated that with some adjustment, reasonable agreement can be achieved by utilizing different methods of assessment in studies of disease in population groups.

For large-scale epidemiological investigations of the various manifestations of periodontal disease, the Russell index⁹⁶ is the one of choice:

1. it is sufficiently simple to be quickly used in large-scale population studies;
2. it has had wide geographic utilization and is the only index which yields world-wide data;
3. reproducibility among examiners is good;
4. where examiner agreement is highest the most advanced phases of pathology are given the highest scores;
5. when used in conjunction with Sandler and Stahl's

recession score,¹¹⁹ a good assessment of actual and comparative periodontal pathology is reflected. Table 1 gives details.

The weighting system was designed to place greater emphasis on advanced disease and to minimise examiner disagreement. In spite of the fact that PI gives much weight to the destructive phases, it is still reversible.

All fully erupted teeth are examined and the individual scores are added and divided by the number of tooth to give the score of that patient.

The population score is the arithmetic average (mean) of the individual scores of the people examined.

Russell states that: most persons considered to be normal, clinically, score from 0 to .1 or .2; those with a clinical diagnosis of gingivitis, from .1 to 1.0; those with severe gingivitis verging on incipient destructive disease, from 0.5 to 1.9; those with frankly established destructive disease from 1.5 to 5.0; and those with disease in terminal states from about 4.0 to 8.0, the maximum score.

TABLE 1 : Criteria for the Periodontal Index

Score* and Description	Criteria for field studies
0 = negative	There is neither obvious inflammation in the investing tissues nor loss of function due to destruction of supporting tissues.
1 = Mild gingivitis	There is an obvious area of inflammation in the free gingiva, but this area does not circumscribe the tooth.
2 = Gingivitis	Inflammation completely circumscribes the tooth but there is no apparent break in the epithelial attachment.
4 = (Not used in the field study)	There is early notchlike resorption of the alveolar crest. Determined by X-ray examination.
6 = Gingivitis with pocket formation	The epithelial attachment has been broken and there is a pocket (not merely a deepened gingival crevice due to swelling in the free gingiva). There is no interference with normal masticatory function, the tooth is firm in its socket, and has not drifted.
8 = Advanced destruction with loss of masticatory function	The tooth may be loose, may have drifted, may sound dull on percussion with a metallic instrument or may be depressible in its socket.

* When in doubt assign the lesser score.

4.2.3 The Plaque Index^{67,68}

This index is fundamentally based on the same principle as the Gingival Index, namely desirability of distinguishing clearly between the severity and the location of the soft debris aggregates.

Each of the four gingival areas of the tooth is scored from 0 to 3, according to the following criteria:

- 0 - no plaque in the gingival area.
- 1 - a film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may only be recognised by running a probe across the tooth surface.
- 2 - moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
- 3 - abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

The assessment of the Plaque Index score is carried out according to the system described for the Gingival Index.

4.2.4 The Retention Index⁶⁸

Bjorby and Loe created this index for assessment of the main retentive factors which express the quality of the tooth surface (degree of roughness) adjacent to the gingival margin. It follows the similar principles as the Gingival Index and the Plaque Index, except that it uses the following criteria:

- 0 - no caries, no calculus, no imperfect margin of dental restoration in a gingival location
- 1 - supragingival cavity, calculus or imperfect margin of dental restoration
- 2 - subgingival cavity, calculus or imperfect margin of dental restoration
- 3 - large cavity, abundance of calculus, or grossly insufficient marginal fit of dental restoration in supra- and/or subgingival location.

4.3 Composite Indices

These indices are a combination of a reversible index and an irreversible one. Main ones being:

- 1. Periodontal Disease Index - PDI of Ramfjord
- 2. Gingival Bone Count - Dunning and Leach
- 3. Periodontal Disease Rate - PDR of Sandler and Stahl.

4.3.1 Periodontal Disease Index^{106,107}

In principle the periodontal disease index as introduced by Ramfjord is a further development of the Russell index; in order to overcome the weak point of no provision for distinguishing between slight and extreme pocket deepening. Ramfjord stated the following eight objectives for a scoring system or an index for periodontal disease:

1. To map distribution of the disease (prevalence)
 - a) in population groups
 - b) within each dentition
 - c) around each individual tooth (mesial, distal, buccal, lingual).
2. To record the progress and behaviour of the disease either by longitudinal studies of the same group or by comparing prevalence studies of various age groups within the same population (incidence).
3. To serve as a basis for evaluation of the role of various etiologic factors in the pathogenesis of periodontal disease.
4. To allow an estimate of total need for periodontal therapy in population groups.
5. To acquire a basis for education of the dental profession, the public and the governmental authorities regarding the need for attention and treatment of

periodontal disease; to estimate future needs for dentists and auxiliary personnel.

6. To serve as a basis for testing and evaluation of various procedures for periodontal treatment.
7. To serve as a basis for evaluation of the effectiveness of various measures in preventing or delaying the loss of teeth from periodontal disease.
8. To serve as a basis for evaluation of measures to prevent periodontal disease.

His system was designed with these objectives in mind and the clinical examination diagnoses and measures gingivitis, calculus, pocketing, occlusal and incisal attrition, mobility, lack of contact and plaque. Only six teeth are selected for examination:

The maxillary right first molar
The maxillary left central incisor
The maxillary left first premolar
The mandibular left first molar
The mandibular right central incisor
The mandibular right first premolar

Classification of gingival findings are as follows:

- G0 - Absence of inflammation.
- G1 - Mild to moderate inflammatory gingival changes not extending all around the tooth.

- G2 - Mild to moderately severe gingivitis extending all around the tooth.
- G3 - Severe gingivitis characterised by marked redness, tendency to bleed and ulceration.

In case there is a pocket deepening below the cemento-enamel junction, not exceeding 3 mm, the gingivitis score is disregarded and a score of 4 is given. Likewise, a score of 5 is given when the pocket deepening is between 3 and 6mm, and a score of 6 when the pocket deepening exceeds 6mm.

The average score is the score of the patient. Independent measurements are made from the cemento-enamel junction to the gingival margin and for the distance from the gingival margin to the bottom of the pocket. These are added or subtracted to arrive at the tooth score.

The measurement of periodontal pocketing is carried out using a special probe (University of Michigan⁰) which is as thin as possible and specially angulated.

For the total inventory of a patient or population the Ramfjord index is probably the most accurate tool as it is based on measurement rather than examination.

The amount of bone loss can with a high degree of probability be deduced from the location of the bottom of

the pocket. The distance from this landmark to the alveolar crest usually is in the vicinity of 1mm.

The PDI is a composite index, i.e., a combination of a reversible index (stages 1, 2 and 3) and an irreversible one (stages 4, 5 and 6).

Due to the high requirement of precision the application of the PDI is rather time-consuming.

In primitive populations with many middle-aged and old people much time must be spent on removing calculus to determine the location of the cemento-enamel junction.

Calibration of examiners is good and the data can be analysed by modern statistical methods.

4.3.2 Gingival Bone Count²⁶

The PDI can be used both as a morbidity index and a cumulative index. The Gingival Bone Count index is another way of combining these two features.

In this index the gingival conditions are indicated on a scale ranging from 0 through 3 and the bone loss (as measured by X-rays) on a scale ranging from 0 through 5.

In both cases one score is assigned to each tooth and the mean is computed for the whole mouth.

The gingivitis score and the bone loss score can be given independently or combined as the GB count, ranging from 0 through 8.

The Gingival Bone Count may be used as a reversible index (G), as an irreversible index (B), or as a composite index (GB).

This index has not been extensively used due to the combination of a clinical examination with the reading of X-rays, it is probably the most time-consuming of all methods, and there is no evidence, to date that it will return more accurate data than the PDI.

4.3.3 Periodontal Disease Rate (PDR)¹¹⁹

Devised by Sandler and Stahl, it is simply a ratio of teeth affected by periodontal disease divided by all teeth and depends on clinical judgments augmented by radiograph.

$$\text{PDR} = \frac{a}{a+b}$$

where a = number of teeth affected by periodontal disease.

b = number of teeth not affected.

a+b = tooth population of the individual patient.

Criteria of periodontal disease in assessing PDR in

epidemiological studies is as follows:

- gingival necrosis, hypertrophy or inflammation encircling the tooth, or a purulent exudate from the gingival crevice.
- a gingival crevice depth of more than 2mm.
- tooth mobility greater than 1mm in any direction.
- roentgenographic evidence of resorption of alveolar bone extending more than 3mm, apically from the cemento-enamel junction.

If the diagnosis is doubtful, the condition is classed as negative. The numerical weight of each tooth increases as the remaining tooth population decreases and this would seem to be a very reasonable relationship.

4.4 Oral Hygiene Indices

Oral hygiene status has long been considered a factor in the etiology of periodontal disease. In the early epidemiological surveys oral hygiene was usually estimated in some arbitrary way (good, medium, fair, poor, etc.). With such subjective categorisations, standardisation and reproducibility are suspect and the need to develop more objective methods of measurement was realised. In 1960,

Greene and Vermillion developed an index for the numerical assessment of oral cleanliness: The Oral Hygiene Index.

4.4.1 Oral Hygiene Index - OHI^{31,33}

This was first described by the authors in 1960 and then later modified by them in 1964 and called the simplified index (OHI-S).³²

Criteria for the OHI-S: six surfaces are selected for examination: the buccal surface of the upper first molars; the labial surfaces of the upper right and lower left incisors; the lingual surfaces of the lower first molars. Each surface is considered to encompass half the circumference of the tooth. All surfaces are first examined for debris and then for calculus.

Oral debris is the soft foreign matter loosely attached to the teeth. The following scoring system is used:

0 - no debris or stain present.

1 - soft debris covering not more than one-third of the tooth surface or the presence of extrinsic stains without debris regardless of surface area covered.

2 - soft debris covering more than one-third, but not more than two-thirds of the exposed tooth surface.

3 - soft debris covering more than two-thirds of the exposed tooth surface.

Calculus scores are assigned according to the same criteria as for the debris scores, with the addition that individual flecks of subgingival calculus are given score 2 and a continuous heavy band of subgingival calculus is given score 3.

The average individual or group scores are known as the debris index (DI-S), calculus index (CI-S) and when added together, the oral hygiene index (OHI-S). This index is swift and criteria are well defined; calibration is good with between examiner differences moderate.

Disclosing agents might be used to decrease examiner error, small differences can be detected. However, in epidemiological surveys where hundreds and thousands of people need to be examined in short periods of time as in Indonesia, the inconvenience of using disclosing agents becomes quite significant in terms of loss of time and, consequently, less adequate coverage of the population.

This simplified oral hygiene index does not possess as great a degree of sensitivity as the original but offers a more rapid method for evaluation of oral cleanliness and it appears to be reasonably sensitive a method for assessing

oral hygiene in population groups.

The criteria of assessing the Oral Hygiene Index:

0.0 to 1.2	good
1.3 to 3.0	fair
3.1 to 6.0	poor

The criteria of both the Calculus Index and the Debris Index:

0.0 to 0.6	good
0.7 to 1.8	fair
1.9 to 3.0	poor

4.5 Need for Periodontal Treatment. Costs in Delivering Necessary Treatment

The following is a quote from the chapter by Aubrey Sheiham, "Planning for Manpower Requirements in Dental Public Health" from the publication Dental Public Health, by Geoffrey L. Slack:¹²²

"Unlike dental caries, which is a major dental health problem in developed countries, periodontal diseases are a universal problem and tend to be more severe in the poorer developing countries where they constitute the major dental health problem (Ramfjord, et al., 1968; Pelton, et al., 1969.)

When discussing the needs for periodontal treatment consideration is often only given to chronic periodontal

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(AUG) 1963

disease. However, acute ulcerative gingivitis (AUG), a condition prevalent in young children in Nigeria (Sheiham, 1966), India (Pindborg, et al., 1966), Gambia (Malberger, 1967), and China (Fu-Tang and Chuan Fam, 1963), and some South American countries, is often a more seriously felt need by the population. This is mainly because cancrum oris is often associated with the severe forms of AUG (Emslie, 1963; Sheiham, 1966; Malberger, 1967). Surveys in Nigeria have shown that 11.5 per cent of children aged 2-6 years had AUG and 0.74 per cent had cancrum oris (Sheiham, 1966).

Chronic periodontal disease commences as gingivitis and progresses to periodontitis and ultimately leads to the loosening and loss of teeth. The condition is prevalent in young children; over 95 per cent are affected (Jamison, 1963; Sheiham, 1967). Indeed, Jamison's study showed that destructive periodontal disease with alveolar bone loss occurs around deciduous teeth. The prevalence remains over 95 per cent for children of all ages, and increasing age the severity also increases in a linear fashion. Pocketing around the permanent teeth is found in 11 year-old English (Sheiham, 1966) and African children (Sheiham, 1968; Skougard, et al., 1969), and by the ages of 20-29 years over 70 per cent of these persons have one or more teeth with pockets (Sheiham, 1968).

The conversion of periodontal findings into treatment needs poses an even greater problem than the similar conversion of dental caries. The problem was recognised by Russell (1956) when he developed the Periodontal Index. He carried out a full clinical and radiographic analysis of a group of persons and then tabulated them according to the stage of periodontal disease; the range of Periodontal Index scores within each clinical group was then estimated.

Persons with clinical diagnosis of gingivitis and requiring no more than a single prophylaxis scored in the PI range of 0.1 to 1.0; those for whom minimal periodontal treatment was necessary to treat severe gingivitis and incipient destructive periodontal disease, from 0.5 to 1.9; persons with scores in the range 1.5 to 5.0 had frankly established destructive periodontal disease requiring elaborate and perhaps protracted periodontal treatment, whereas for those with the terminal of periodontal disease (scores 4.0 to 8.0), full mouth extraction was the most rational treatment.

On the basis of these findings Russell (1967) has estimated that about 5 million of the 90 million United States adults who have natural teeth had periodontal disease so advanced that extractions were indicated; a further 30 million required highly skilled and elaborate treatment; 25 million required a simple prophylaxis. Using the same method of assessment Sheiham (1968) estimated that the periodontal treatment needs of British populations were greater than those in the United States. Firstly the mean Periodontal Index was much higher, and secondly the percentages in each of the periodontal disease categories were higher in the British population. Sheiham (1971) estimated that 42 per cent of British adults aged 16-65 years required extractions for the treatment of their advanced periodontal condition, 44 per cent needed highly skilled and elaborate periodontal treatment, and the remaining 14 per cent a simple prophylaxis.

Going by these estimates from highly industrialized countries with better dentist:population ratios than the majority of developing countries, and knowing that the severity of periodontal disease is less in the United States

than in the majority of developing countries (Pelton et al., 1969), the estimates of needs for periodontal treatment are even higher in India, Africa, Asia and South America than those reported here. In the case of Nigeria (Sheiham, 1968), 11.5 per cent of 3,842 persons aged 6 months to 84 years were in the terminal stages of periodontal disease, 69 per cent had destructive periodontal disease, and 19 per cent had gingivitis only.

In Nigerian males aged 20 to 24 years, 18 per cent were in the terminal stages of disease and 45.5 per cent of 40-44 year-old males were similarly affected (Table A).

These estimates of periodontal diseases are under-estimates of the true need because the examination for the PI is a quick scanning rather than a detailed clinical diagnosis. If more detailed diagnosis is required then the Periodontal Disease Index (PDI) (Ramfjord, 1959) should be used. This method measures (1) plaque, subgingival and supragingival calculus, teeth present, and gingivitis; (2) depth of periodontal pocket; (3) alveolar bone height; and (4) mobility. All these are essential factors in making a more accurate estimate of treatment needs.

Although this scoring method, and a recent modification of it developed by O'Leary (1967) has been used for over 10 years, no large-scale study has been carried out to assess periodontal needs, and the time and personnel necessary to treat those needs. This neglect may be largely attributed to the preoccupation of public health dentists with the treatment of dental caries."

TABLE A : Periodontal Treatment Needs in Nigerians
by Age and Sex (Sheiham, 1968)

Age in years	Simple prophylaxis. (percentage)		Skilled and elab- orate treatment (percentage)		Extractions (percentage)	
	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>	<u>Male</u>	<u>Female</u>
10-14	12.5	31.3	86.1	67.1	1.1	0.7
20-24	13.3	18.3	80.1	63.5	6.6	18.2
30-34	4.2	7.1	49.0	62.5	46.8	29.4
40-44	1.4	9.1	43.5	45.4	55.1	45.5
50+	1.2	5.1	36.7	42.3	62.1	52.6

Since Dr. Sheiham wrote the above, there has been some development of indices to assess periodontal needs and the costs involved in treating these needs.

4.5.1 The Periodontal Treatment Need System -
PTNS - developed by Johansen, Gjermo
 and Bellini (1973) 11,58

As the authors remark, their paper is concerned with planning of periodontal treatment delivery: "Any delivery system must provide realistic pictures of the needs for prevention and therapy, including estimations of manpower and resources involved. The following requirements must be filled:

1. The method should be useful for evaluating the need for periodontal treatment.
2. The therapeutic procedures should be classified and related to time.
3. A basis for calculation of manpower and costs in delivering the necessary treatment should be provided.
4. The method should be simple and quick in field studies.

The Periodontal Treatment Need System - PTNS - is based on an evaluation of the need for (1) Motivation and oral hygiene instruction (OH); (2) Scaling and elimination of overhangs (Sc); (3) Surgery (Su), and on the time needed to perform the various types of treatment.

Classification

Class 0 - no treatment needed
Class A - motivation and oral hygiene instruction
Class B - scaling and removal of overhangs
Class C - surgery.

In Class A, only one classification is needed for the whole mouth and can be given alone or together with the other classes.

For Classes B and C, each quadrant in the mouth is scored separately. A quadrant is defined as a segment containing 4-8 teeth. Less than 8 teeth in one jaw is

considered as one quadrant. Four teeth or less in the mouth are recorded as one quadrant.

Criteria for Classification:

Class 0 - Patients with no clinical signs of inflammation.

The location of the gingival margin is disregarded.

Class A - all patients needing any kind of periodontal treatment are grouped here. In the presence of gingivitis and supragingival plaque only (no calculus nor overhangs), the patient is classified only in this class.

Class B - in this class each quadrant with one or more pathologic pockets 5mm deep or less, is included. The registration of one quadrant in this class implies that Class A must be added.

Class C - in this class each quadrant with one or more pathologic pockets deeper than 5mm is recorded. Any quadrant classified as C will also require Class A and B treatment.

The criteria for classification are presented in Table B.

TABLE B : Criteria for the Periodontal Treatment Need System (PTNS) Classification

PTNS classification	Unit	Plaque	Calculus and/or overhangs	Inflammation	Pocket depth
Class O	Mouth	no	no	no	*
Class A	Mouth	yes	no	yes	5mm
Class B	Quadrant	yes	yes	yes	5mm
Class C	Quadrant	yes	yes	yes	5mm

*not considered

Conclusions

1. The Periodontal Treatment Need System (PTNS) was proposed for planning periodontal treatment in public health dentistry. It indicates the type(s) of treatment needed and it gives an estimation of the treatment time. Thereby manpower and treatment costs can be calculated.
2. The system appeared to be reproducible.
3. Time averages for motivation and instruction in oral hygiene, scaling and elimination of overhangs and surgical procedures were suggested as basis for estimations of manpower and costs.

CHAPTER 5

ORAL HEALTH PROBLEMS IN INDONESIA

5.1 Introduction

Indonesia is the largest archipelago in the world. It consists of more than 3,000 islands and covers an area about 1,100 miles from north to south and 2,800 miles from east to west. The total land area is about 815,865 square miles. It has been estimated that in mid-1975 the total population of Indonesia was about 132 million. Approximately two-thirds of the population live on Java and its two offshore islands of Madura and Bali. These three islands together comprise only 7 per cent of the total land area of Indonesia.

The Indonesian climate is a typically tropical one, having a dry and a rainy season, with an average temperature of 78°F. Indonesia can be considered a potentially rich country because of its wealth of natural resources. However, its National per capita income is among the lowest in South-East Asia despite this wealth of natural resources.

Social life in Indonesia is strongly influenced by magico-religious traditions, habits and customs. Some rural communities still believe that magical or supernatural causes are responsible for disease and death. However, with the increasing development of the educational system, these old beliefs are disappearing and are to be found now only in some of the rural communities in Irian Jaya.

Indonesian is the official national language, however most people in the communities still use their local language of which there are approximately 400.

More than 80 per cent of the population belong to the Moslem religion, while others are Christian, Hindus and Buddhists.

The country is administratively divided into 25 provinces each of which is headed by a Governor. Each province is divided into regencies (Kabupaten) in which there are subregencies (Kecamatan), consisting of small numbers (3-5) of villages. The provinces are autonomous in character, having their own budget besides receiving a subsidy from the Central Government.

5.2 General Health Conditions

The infant mortality rate is 100 per 1,000 live births. Maternal rate is 4 per 1,000 live births and the crude death rate is about 17 per 1,000 population. Indonesia has a predominantly young population with about 50 million under the age of 15 years.

5.3 Dental Education

At the present time Indonesia has seven dental schools; five government and two private. Three of these schools are located in Jakarta, whilst the other four are split between Yogyakarta, Surabaya, Ujung Pandang, and Medan.

The output of graduates will be 200-250 per year after completion of a five-year course following matriculation from Senior High School.⁸³

Over the last ten years the curriculum of the Dental Schools began to change in order to emphasise community dentistry.

At the University of Gadjah Mada, Yogyakarta, training in public health dentistry is becoming more important and is being given to fifth year undergraduate

students. Every final year student has to undertake a total of two months "in service" training under supervision of the Department of Public Health, within the Faculty of Dentistry.

Community Dentistry in Yogyakarta is being taught by the Faculty of Dentistry in cooperation with Government Health Centres (Pusat Kesehatan Masyarakat) and the Foster Parents Plan. The 18 faculties of the Gadjah Mada University, both staff and students, are also involved in various forms of community services under supervision of the Comprehensive Community Health Care (Lembaga Pengabdian Masyarakat), e.g., the faculties of Medicine and Dentistry are concerned with various community health problems and also the programmes related to these problems.

The number of graduate dentists in 1972 was about 1,518, the majority of which were in Government Services. The majority of operating auxiliaries are school dental nurses numbering about 268, and there are four dental hygienists. The four dental hygienists are not employed in Government Services but work for various private agencies such as the private universities and missions.

Dentist/population ratio - 1:78,037
 Physician/dentist ratio - 3.4:1
 Ratio D/N:population - 1:400,000 (total population)
 The number of non-operating auxiliaries are - dental technicians about 35 and chair-side assistants about 77.²

5.4 Oral and Dental Health Conditions

To date there is very limited data available for planning oral health programmes. With such limited data it is reasonable to expect that some errors of judgment will be made when designing programmes in both dental public health and dental health education. In 1954 the first dental survey was conducted,⁸³ when 20,285 school children between the ages of 6-16 years in 15 cities were examined according to standards laid down by the Department of Health. The survey showed that DMFT rate started with 0.54 at the age of 6 and increased to 3.80 at the age of 16 years. The DMFT of girls was higher than the DMFT for boys. More than 60 per cent of the children needed treatment of their permanent teeth, of all affected teeth only approximately 1.4 per cent had been filled and approximately 90 per cent needed fillings and 9 per cent required extractions.

From Irian Jaya, where the people still live in a primitive way, a survey has shown that the DMFT rate of children aged 6-10 years is 0.4 and rises to about 2.1 at 16 years. There are places in Irian Jaya where 50 per cent of the school children have no caries of their permanent teeth.⁸³ Moreira reported⁸¹ that from personal communication (1974) with Soeria Soemantri who surveyed

11,000 children in Bandung in 1968-1969, mean DMFT values ranged from 0.5 in 6 year-olds to 2.1 in 15 year-olds.

In 1972, some 3,200 children in areas of Java, Sumatra, Kalimantan and Sulawesi were examined. The results showed that children aged 6 to 14 years have DMFT values about twice those of Bandung children. Also Moreira reported in a personal communication with R.G. Noor, that periodontitis occurs in one-third of the children aged 6 years and two-thirds of those aged 12 years. It can be seen from these reports that caries experienced in children in Indonesia is relatively low compared to periodontal disease which appears to be a more serious problem.

National surveys of member countries of the APDF (1963-1974) showed that the mean DMFT per 12 year-olds was 4.5 (see Table 2).

Epidemiological surveys which have been done to date are not adequate enough to give a true picture of the prevalence of periodontal disease in Indonesia. The criteria used in these surveys for assessing periodontal disease were not those suggested by the World Health Organisation. Therefore the survey results from Indonesia cannot be compared with those from other countries who used standardised W.H.O. methods. However, the most

TABLE 2 : Survey of member countries APDF/APRO Committee on Public Dental Health. National Survey Results for Dental Caries (1963-1972)

Country	dft per 6 year-old child	DMFT per 12 year-old child
Australia	5.0-7.2 (6 years)*	7.2-12.0 (12 years)*
Hong Kong	5.3 (5-8 yrs)	2.0 (12 years)
Indonesia	-	4.5 (12 years)
Japan	9.4 (6 years)	4.9 (12 years)
Korea	2.9 (7 years)	0.6 (11 years)
Malaysia	6.3 (6 years)	3.7 (12 years)
New Zealand	6.6 (6 years)	9.5 (12 years)
Philippines	4.7 (5-6 yrs)	1.4 (13-14 yr)
Singapore	4.8 (6 years)	2.6 (12 years)
South Vietnam	10.1 (6 years)	7.4 (12 years)
Taiwan	6.9-8.0 (5 years)	0.5-2.8 (7-17 yrs)
Thailand	-	0.6 (12 years)

*Ranges from State Survey - Fluoride areas are less

recent survey is that undertaken by the Department of Health in 1972 and shows that between 8 and 44 years of age, there is an overall very high prevalence (almost 100 per cent of all people in all age groups) of gingivitis and both an increase in amount and severity of periodontal disease with increasing age. This increase

in severity is very possibly associated with the increase in calculus (see Table 3).

Reports in 1971 showed that approximately 52 million children were under the age of 15. There was a high prevalence of gingivitis among children, ranging from 60 per cent in 6 year-olds to 80 per cent in adolescents. In middle-aged groups there was gross gingivitis and ultimate tooth loss from this.

In the Report of the APDF/APRO Committee in Public Health (1974) it showed that the percentage of 6 year-olds with periodontitis was 36 per cent and with gingivitis was 27.3 per cent. At the age of 12, these percentages became 50 per cent and 68 per cent respectively (see Table 4).

Another survey that was conducted in five cities in Indonesia of the 6-15 year-old age group showed that an average of 43.3 per cent suffered gingivitis (Table 5).

Table 6 shows results of survey undertaken of orphans in Jakarta in the 13-18 year age group (Pra Yuwana). It showed that the boys had an average PI of 1.9; 58.3 per cent showed reversible periodontal disease whilst 12.4 per cent showed irreversible periodontal disease.

TABLE 3 : Assessment Survey Results: Periodontal Disease
(Basic Planning Based on 6-12 years)

Age	Population Group	N	% Gingivitis	% Periodontitis	PI	0	1	2	6	8	% Calcu- lus
8	z = total	432	99	2	0.02						71 moder- ate
15-19	z = total	492	99	36	0.67						93 high
25-29	z = total	218	97	80	2.11						97 high
35-44	z = total	850	99	50	2.14						100 high

Raw data analysis of Survey undertaken by Department of
Health, Indonesia, 1972.

**TABLE 4 : Survey of Member Countries
APDF/APRO Committee on Public Dental Health
National Survey Result for Gingivitis and Periodontitis (1963-1972)**

Country	Age 6 Gingivitis (periodon- titis) %	Age 12 Gingivitis (---) %	Age 15-19 Gingivitis (---) %	Age 35-44 Gingivitis (---) %	Age 45-54 Gingivitis (---) %
Australia	(-) -	(-) -	(-) -	(-) -	(-) -
Hong Kong	63.3 (-)	73.1 (-)	81.0 (-)	93.4 (49.0)	- (-)
Indonesia	27.3 (36)	50.0 (68)	- -	- -	- -
Japan	- (-)	- (-)	(27.45) (-)	(58.20) (-)	- (-)
Korea	(7yr) PI 0.40	(11yr) PI 0.44	14yr PI 0.41	- -	- -
Malaysia	51.7	60.4	51.4 PI 0.48	-	-
New Zealand	- (-)	- (-)	- (-)	- (-)	- (-)
Philippines	12.2 (-)	23.6 (-)	22.2 (1.4)	38.7 (19.2)	44.6 (34.6)
Singapore (Chinese)	66.0 (-)	73.0 (0.9)	77.5 (7.2)	- (-)	- (-)
South Vietnam	- (-)	- (-)	- (-)	- (-)	- (-)
Taiwan	Age groups 6-14 PI 0.2-0.4				
Thailand	(PI 0.23)	(PI 0.37)	(PI 0.45)	(PI 2.86)	(PI 5.03)
	Age groups 35-54 PI 0.5-1.5				

**TABLE 5 : Prevalence of Gingivitis in Children 6-15 Year Age Group
Five Cities Survey in Indonesia**

Age	Semarang N(%)	Surabaya N(%)	Manado N (%)	Pontianak N(%)	Palembang N(%)	Total N(%)
6	9(45.0)	0(0)	13(68.4)	-	8(44.4)	30(42.2)
7	26(55.3)	8(12.3)	34(58.6)	6(26.1)	23(32.4)	97(36.3)
8	24(45.3)	15(17.8)	43(78.2)	9(20.0)	35(46.1)	126(40.3)
9	37(58.7)	23(22.5)	63(90.0)	15(24.6)	22(34.9)	160(43.3)
10	37(53.6)	19(25.7)	56(93.3)	17(23.6)	37(52.1)	166(48.0)
11	37(46.8)	13(30.2)	48(96.0)	15(19.0)	19(38.0)	132(43.8)
12	32(40.9)	17(28.8)	80(100)	10(13.7)	33(49.3)	172(45.7)
13	13(37.1)	7(29.2)	31(100)	14(19.2)	16(37.2)	81(39.3)
14	18(72.0)	12(50.0)	10(94.7)	3(8.8)	6(42.9)	49(42.2)
15	5(100)	5(45.4)	7(100)	1(6.2)	6(60.0)	24(49.0)
Total	238(49.7)	119(24.8)	385(86.6)	90(18.4)	205(42.2)	1037(43.3)

TABLE 6 : PI Score of Pra Yuwana Boys
(13-18 Age Group)

Age	N	P I SCORE					Total Score	Average
		0 %	1 %	2 %	6 %	8 %		
13	17	5	2	9	1	0	26	1.5
14	53	15	1	34	3	0	87	1.6
15	44	12	0	24	8	0	96	2.2
16	63	16	0	39	8	0	126	2.0
17	45	14	1	25	5	0	81	1.8
18	44	16	0	20	8	0	88	2.0
	266	78	4	151	33	0	504	1.9
		(29.3)	(1.5)	(56.8)	(12.4)	(0.0)		

in 1973 (Health Department)

iod. ease	Abscess	Persistent	Other	Population
-	35= 6.71%	125=23.54%	105=19.77%	
03=11.43%	428= 8.11%	609=11.54%	317=6.01%	
51=11.51%	365= 9.32%	437=11.16%	325=8.30%	
85=30.62%	323= 5.87%	169= 3.07%	288=5.23%	
73=12.95%	1971=26.23%	651= 8.66%	35=0.46%	
97=43.40%	481=11.61%	639=15.43%	113=2.72%	
75=10.71%	225= 8.76%	233= 9.07%	709=27.61%	
50=58.43%	151= 7.05%	288=13.46%	109= 5.09%	
32=12.51%	272=25.78%	180=17.05%	123=11.65%	
00=2.88%	176= 5.06%	374=10.79%	-	
62=27.32%	317=11.36%	311=11.15%	123=3.24%	
07=22.93%	211= 2.83%	1325=17.79%	1518=17.70%	
61=16.60%	861=16.60%	400= 8.14%	115= 2.34%	
54= 2.15%	54= 2.15%	62= 2.47%	18= 0.71%	
40=13.57%	59= 5.84%	136=13.47%	127=18.55%	
-	5= 1.57%	64=20.12%	35=11.00%	
41=21.46%	5889=10.74%	6003=10.97%	3920=7.16%	11555.869

A report that was collected in 1973 from clinical services of six provinces showed that periodontal disease was present in an average of 21.46% of the total patients who attended the Community Health Centres (Table 7).

In the seven cities study of Indonesia, the rural study included, measurement of periodontal disease and calculus both recorded the usual high prevalence of gingivitis. The rural study in addition, demonstrated a moderate to high periodontal index and a very high prevalence of calculus. It was clear from data and observation that periodontal conditions were severe at early ages in both rural and urban populations, and overall was a greater oral health problem than dental caries.

5.5 Preventive Dentistry

Like other developing countries, Indonesia has a young population. In 1971 approximately 43.3 per cent of the population were children, i.e., 15 years of age and under. It is reasonable that preventive oral health programmes must be established with a priority given to children. Two-thirds of the children under the age of 12 are suffering from moderate to severe periodontal disease.

Tooth loss is associated more with periodontal disease than caries, so that preventive programmes should be directed towards this disease rather than caries. The dental and oral health problem is such that it requires a high degree of community involvement in attempting to solve it. Dental health planners or dental health educators must remember not to go against traditional customs which are still practised, especially in rural communities. In fact, they must make use of such customs in their educational programmes in order to establish a rapport with the people of differing customs and backgrounds.

In his private clinic, the author has experienced these problems; for example:

1. During the fasting days in the Moslem religion, people do not wish to have extractions although they need treatment. Then the author tried to persuade them by giving advice and information so that they agree with that treatment.
2. Sometime people refused to undertake the treatment outlined by the dentist, because they must have agreement from their family before such treatment is carried out.
3. People still believe that treatment of the upper jaw may disturb the eyes.

4. Some people from one local area are unwilling to accept advice and treatment from a dentist who comes from another area.

For such reasons, dental health programmes should have flexibility so that they are acceptable to each particular community.

Dental health education should be given through:

- the school children also involving the parents as participants
- the community and involving its traditional leader
- a campaign involving mass media, such as T.V. and radio
- voluntary agencies
- community health centres.

Dental health programmes should be based upon establishment of a daily oral hygiene exercise in all primary schools. It should be noted that the main component of dental health programmes in most rural areas is prevention, with curative treatment limited to elimination of pain and acute infection.

In the APDF/APRO Conference held in Jakarta in June 1974,² the Indonesian Dental Association suggested the

following priority needs for improving dental services in Indonesia:

- dental health education for public, prevention measures for school children; training of dental auxiliaries. Provision and expansion of basic dental care for the general public.

The Association also recommended the following specific programmes related to these priority needs:

- dental health education programmes through all health centres (Pusat Kesehatan Masyarakat), mouth rinsing (fluor) and other fluoride topical application programmes for all school children.

Incremental dental care for school children in high caries rate areas: treatment programme for 14 year-old school children in low caries. Tooth-brushing campaign for all school children. Water fluoridation programmes in the bigger cities after feasibility study, provision of basic dental care in health centres with referral for specialised treatment to hospitals.

CHAPTER 6

PREVENTION OF PERIODONTAL DISEASE

Because of their widespread nature both periodontal disease and dental caries are public health problems, therefore consideration of prevention should be taken into account as early as possible.

It is advisable, because of the fact that periodontal disease develops slowly but surely and its effects may not be readily seen, detection of the disease should be considered at the age of 13. This is taken as the lower limit, as by then the secondary dentition, except the third molars, should have erupted, and destructive periodontal disease is rare before that age.

The oral cavity and its contained structures are in intimate relationship with the external environment and subjected to mechanical, chemical, and bacterial insults, rarely experienced by other body cavities, thus making it unusually vulnerable to disease. For these reasons the oral tissues are sensitive indicators of the general health of the patient and changes in these structures are commonly

the first indication of a systemic disease process.¹²⁷ It is desirable that there should be early recognition of oral health disturbances. Early recognition and prompt treatment of oral health disturbances can prevent extension to deeper structures and loss of bone support. From previous data, it is obvious that the periodontal disease problem is one of overwhelming proportions. It would be impossible to provide treatment for more than a small fraction of the number already affected. The only possible solution to this major health problem is prevention.

Prevention of periodontal disease consists of: primary prevention of the onset of disease is accomplished by the avoidance or the removal of etiologic agents prior to the time when they produce deviations from health. Thus preventing the mutilating effects of the disease.⁴³ Secondary prevention is largely therapeutic in nature, and is the prevention of recurrence of disease after therapy.

Frequently preventive measures in adults is inadequate because the damage has been done and it is too late to preserve the dentition. Prevention must start with the young.

Prevention of periodontal disease is a cooperative effort involving the dentist, his auxiliaries, and the patient.⁴⁴

6.1 Prevention by Dentists and their Auxiliaries

It is desirable that routine inspection of the oral cavity and oral prophylaxis should be performed carefully so that there is detection and elimination of the disease as soon as possible; recognition of bad habits, caries lesions and the need for dental restoration and orthodontic treatment.

Dentists and their auxiliaries, such as dental therapists, dental hygienists and dental nurses, in their treatment of the community should not only treat the main complaints of patients, but they should motivate them to recognise that they have 'something wrong' in their mouth.

It has been shown in the previous chapter that gingivitis and periodontal disease can be reduced by good oral hygiene. Plaque, debris, calculus and other local irritants which cause oral disease must be prevented from accumulating on the tooth surfaces. In other words, regular removal of accumulated bacterial deposits will greatly reduce the incidence of caries and periodontal inflammation.⁷⁴

It is most important that patients be made to understand how vital the control of dental plaque is to the maintenance and preservation of dental and oral health. The challenge to the dental profession is the motivation of

the patient to follow an effective plaque control programme.⁹
The most effective means of changing a patient's plaque control behaviour is to lead him to convince himself that it is right and proper for him to practice adequate oral hygiene.⁵⁷

It is obvious that dentists and their auxiliaries, as educators, should have the ability to motivate patients to undertake essential personal oral health care programmes. This is the main goal in behavioural modification, and dentists and their auxiliaries should have knowledge in knowing how to use psychology in order to make this motivation both simple and effective. The educator should guide patients to the self-discovery of the need to remove plaque; effective ways to remove it; and finally to the desire to have a healthy mouth free of plaque. The object is to have patients recognise that they have an oral health problem and to seek advice from dental health personnel as to overcoming it.

Sometimes dentists fail in their plaque control methods because they have not created a 'felt need' for such control. By threatening that periodontal disease is a health hazard, the educators cannot achieve their goal. Motivation by using rewards is better than threats.

Another reason that dentists fail to motivate their patients is that patients may change their habits for the best in the beginning but then lose their motivation as the months pass.⁸⁹ To solve that problem, Parr (1973) illustrated the rules to the clinical problem as follows:

1. Getting the patient to begin.

When entering an office for an examination, patients usually have no knowledge and are unaware they have dental plaque. The dentist should create a felt need for plaque control after the recognition that the patients want to start learning about plaque removal.

The next step is, that dentists should clearly demonstrate to patients that:

- their mouth contains signs of disease, and bacterial plaque is the cause.
- they, therefore, have bacterial plaque in their mouth.
- they can remove plaque.
- by removing plaque they can achieve (some benefit).

By following these steps, one can convert the original needs into ones having clean teeth producing rewards.

This sequential series will usually be successful in having patients at least START learning about plaque removal.

2. Keeping the patient interested while learning.

The patient learns small segments of information at a rate he can absorb. If he can see achievement and receives praise for small, day-to-day improvements, the learning experience is enjoyable and the teacher is viewed as a helper. Failure probably occurs by turning-off motivation. If too much is given too quickly, they feel lost and overwhelmed by the degree of difficulty.

3. Maintaining performance and frequency.

Achieving persistence is a never-ending project. Just keep looking for the pleasures patients gain by cleaning their teeth and use them to shore up sagging interests.

Education in oral health should not only involve school children, but it should extend throughout the family group and the community at large. By establishing school dental clinics which are operated by trained auxiliaries, there would be early recognition of periodontal disease.

The use of fluoride supplement such as fluoride rinses, topical fluoridation and fluoride tablets is necessary, besides tooth brushing instruction. It seems

to reduce caries incidence and leads to a reduction of gingivitis as demonstrated during a two-year study.¹⁰

Dental health education in the young should be performed carefully with the cooperation of their parents. It is important to remember that if the child is treated like a child, he will act like a child. If he is treated like an adult, he will act like an adult, and the educator/therapist will have made a friend for life. Cooperation with their parents is useful in order to motivate them because the child usually adopts the parents' habits.

The young person from 12 years through late teens must be considered and treated like an adult. There must be a programme, as just flossing and brushing will not turn anyone on, especially the ones in this age group. One should treat him as an intelligent person and respect him for his intelligence. These people are children, but a little older, and they too are eager and willing to learn, but learning is more readily accepted if it can become a direct concern to them. The reinforcement of the learning process is the primary goal of preventive maintenance.

In his report, Everingham (1974) said that children were considered to have the highest priority in this area largely because of the need to foster early habits of hygiene

and timely treatment and because the effects of dental diseases are in the main, irreversible. It was considered that the most effective way of reaching children was to take the service to the child at school rather than wait for the parent to seek treatment either from a private practitioner or from an organised public service.^{29A}

The child is seen every six months by the dental auxiliaries and the following is done:

1. Oral hygiene is checked, and any necessary steps taken to effect an improvement.
2. The teeth are scaled, if necessary, and polished with a fluoridated prophylactic paste.
3. A topical solution of either stannous fluoride or acidulated phosphate-fluoride is applied to the teeth.
4. The child's mouth is examined and arrangements made to treat any lesions of teeth or soft tissues.
5. The need to refer to the dental health professional is recognised and arrangements made for such a referral.

6.2 Prevention by Individual

The individual must be made aware of the need for preventing periodontal disease. Besides regular visits to

dental health workers, individuals should be motivated to undertake plaque control, by tooth brushing and other means of achieving good oral hygiene.³⁵

The dental educator should use his ability in communicating with individuals to motivate them undertaking preventive care programmes. If, because of lack of interpersonal skills, he conveys a negative attitude, interacts adversely with his patients and does not communicate an understanding of his patients' feelings,²⁷ he will not be effective.

As we know that periodontal disease is primarily due to bacterial products causing breakdown of the periodontal tissues, methods of prevention can be directed towards eliminating or controlling the bacteria which produce the disease, or to increasing the resistance of the periodontal tissues to these bacterial products.

The classical method for eliminating products of bacteria is by regular use of the toothbrush and toothpaste or other devices such as chewing sticks, wood points or dental floss. The toothbrush has been widely used throughout the world but only few people use it in the proper way, as it is used without the awareness that it can prevent bacterial development. The educator should recognise this problem and he should motivate them in using the toothbrush

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properly.⁶⁹ Rather than basing motivation on the somewhat abstract term 'oral health', it should be based on the fact that tooth brushing gives better oral cleanliness and a cleaner, fresher and more comfortable feeling mouth. This approach is especially applicable to children.

The effect of time of day, eating since the teeth were last brushed, was examined by McKendrick.⁷⁵ He found that:

- increasing the frequency of tooth brushing produced a statistically significant reduction in oral debris.

- more frequent brushing tends to give better plaque control and improved gingival health. However, there is recent evidence indicating that, as far as maintaining gingival health is concerned the efficiency of tooth-brushing may be more important than its frequency since thorough cleaning once every second day will maintain gingival health.

Conventional mechanical means of plaque control, that is effective oral hygiene procedures with toothbrush, floss, tooth picks, etc., were compatible with good gingival health when performed at 48-hour intervals. However, with intervals of 72 to 96 hours, noticeable gingivitis developed.^{108,113} With improvement in plaque control there is a progressive improvement in gingival

health; therefore any improvement in the efficiency of obtaining oral hygiene is of value.

Addition of toothpastes are optional, but they could have some value as an adjunct to toothbrushing in making the mouth feel clean and fresh. However, their significance in the prevention or control of periodontal disease has failed to be demonstrated, except for gingival inflammation.¹²⁸

CHAPTER 7

SUMMARY

1. Periodontal disease is one of the most widespread diseases of mankind. No nation and no area of the world is free from it. It affects in some degree, approximately half the child population and almost the entire adult population.
2. Periodontal disease is a function of age. The potential for advanced disease, however, develops at an early age. Investigations during the early stages of the disease offer the best chance for determining causation and for implementing new preventive techniques.
3. In developing countries, periodontal disease is more prevalent in females than in males, whereas in well-developed countries it seems reversed. It may be associated with nutrition and socio-economic factors.

4. There is a strong correlation between the severity of periodontal disease and oral hygiene. The higher the periodontal scores, the worse the oral hygiene status.

5. With improvement in socio-economic status, such as better education and higher incomes, periodontal condition improves.

6. Unequivocal association was found between tobacco and betel consumption and periodontal disease.

7. The association between periodontal disease and general diseases, except for diabetes, is not strong.

8. There is positive association between caries and gingivitis although the degree of correlation is variable. This can be explained by the fact that both caries and periodontal disease are plaque induced.

9. Correlations with fluoride concentration in the drinking water, malocclusion, traumatic occlusion are not very strong. There is a need for further investigations in these areas to clarify the conflicts in the epidemiological studies of them.

10. Periodontal disease is much more prevalent and much more severe in some Asian and African countries than in U.S.A. and some European countries. However, this difference is unlikely to be a racial predisposition but rather one of differing socio-economic backgrounds.

11. There are many indices to classify the periodontal status of a person or population with a single figure which takes into consideration prevalence as well as severity of the condition. A new development is that of indices showing treatment needs and costs involved in programmes for control and prevention.

12. Attempts should be made to change behaviour of people in order to motivate them in desiring clean mouths.

13. For good oral hygiene and healthy mouths, effective plaque control is required.

14. Current Indonesian studies show that:

- in children there is a higher prevalence of periodontal disease than caries;

- periodontal disease is a serious problem in that two-thirds of children suffer from some form of periodontal disease;

- the severity of periodontal disease is related to the existence of calculus;

- there is a need for further investigations in order to evaluate current programmes;

- correct tooth-brushing and mouth-rinsing should be taught concurrently through the schools and community health centres;

- water fluoridation should be implemented in the big cities where practicable;

- dental health education programmes should be instituted through community health centres and schools.

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