EPIDEMIOLOGY OF PERIODONTAL DISEASE AND THE PATTERN OF DENTAL SERVICE UTILIZATION IN AN INDUSTRIAL POPULATION, ADELAIDE SOUTH AUSTRALIA.

A project submitted in partial fulfilment
for the Degree of Master of Dental Surgery

by

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1982

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SIGNED STATEMENT

This research report is submitted in partial fulfilment of the requirements of the Degree of Master of Dental Surgery in The University of Adelaide.

The report contains no material which has been accepted for the award of any other degree or diploma in any University. To the best of my knowledge and belief, it contains no material previously published or written by another person except when due reference is made in the text of the report.

WORO SRIKANDI.

ACKNOWLEDGEMENT

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This thesis is dedicated to Sister Kien, who in her untiring efforts to preach preventive dentistry amongst her people in Indonesia was an inspiration for this project and my motivation for its completion.

The project was made possible by the goodwill and excellent co-operation provided by the General Motor Holden Ltd. management and staff, particularly Dr. D. J. Guthrie (Medical Superintendent), Mr. C. Abraham (Personnel Officer) and all employees who participated in the survey.

I sincerely thank the Administrator of the Dental Department, Royal Adelaide Hospital, for his support and the provision of nursing assistance. Dental nurses M. Quinn, R. Chappel, C. Camerlenggo and C. Newman were a cheerful and efficient survey team and a joy to work with.

Dr. H. Kennare, Director of Dental Health Services, S.A. Health Commission kindly provided dental caravans for the survey.

Cooper Laboratories Pty. Ltd. and Johnson & Johnson Pty. Ltd. generously donated oral hygiene aids for survey participants.

I thank Svein Johansen for the help and useful discussions regarding the survey.

I am grateful to Dr. D. M. Roder, who was a helpful source of informative consultation throughout the study.

Mr. P. I. Leppard's considerable efforts in designing the statistical methodology and data analysis are gratefully acknowledged.

I am indebted to my supervisor Dr. N. G. Clarke for his

help in conducting the survey and for editorial assistance in preparing this report. His continuous support and counsel provided encouragement extending beyond the completion of this study.

A special thanks to my husband John Goodhart and daughter Devi, for their unfailing encouragement, caring support and understanding.

SUMMARY

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A "convenience" sample of the general population in the Adelaide Metropolitan Area consisting of 680 employees of an industrial company participated in an epidemiological survey. The pattern of dental service utilization, tooth loss, periodontal status, perception of periodontal disease and oral hygiene habits were evaluated against background variables of age, sex and socio-economic status. A self-administered questionnaire and the recently proposed W.H.O. periodontal survey method (52) were used to gather the data. Tooth loss increased with advancing age and females had more missing teeth than males of corresponding age groups, while subjects who visited the dentist regularly had a mean of 3.81 missing teeth compared to 4.91 for irregular attenders. Mild periodontal disease affected approximately 60% of the subjects but severe periodontal disease was evident in 25% of the study population. Reversible gingivitis was found in 11.1%, only 4.2% of subjects were free from any signs of periodontal disease. More than 90% of pockets detected occurred interproximally. Periodontal disease prevalence and severity were significantly associated with age, but not with socio-economic status, regularity or frequency of dental visits, nor with their perception of disease presence and oral hygiene habits. The periodontal status was translated into treatment need data and estimation of the treatment time required was calculated using W.H.O. guidelines (52) as well as P.T.N.S. estimate (79) to

exemplify an approach to manpower and cost evaluation. The major treatment requirement in all age groups could be categorised as "simple periodontal treatment", manageable by non-specialist dental resources. Of the study population, 50.5% had visited the dentist within the previous year and 42.5% had regular checkups. The most common reason for non usage of dental service in the past year was an assumption that nothing was wrong. Most subjects were unaware of the presence of periodontal disease despite its high prevalence as revealed by oral examination. The problems of analysing sociological aspects of dental behaviour were discussed.

More than 90% of participants brushed their teeth at least once daily, but only approximately 10% claimed to practise interproximal cleaning.

The study population's pattern of service utilization was found to be similar to that reported for the general population, and their oral hygiene habits were expected to be similar. This seems to imply that the high prevalence of periodontal disease found in the study population may also prevail in the general population of similar age group. The present study further implies that as the periodontal status of regular attenders was not significantly better than irregular attenders, increasing the utilization pattern would appear to offer little hope of improving periodontal status unless better methods of diagnosis, prevention and treatment are employed.

CHAPTER 1

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BACKGROUND AND OBJECTIVES

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CHAPTER I

BACKGROUND AND OBJECTIVES

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Epidemiological studies in various parts of the world have consistently found that periodontal disease is highly prevalent and surveys of school children and pregnant women indicate that periodontal disease may also be widespread in South Australia (54, 133, 134).

Surveys of tooth loss in South Australia showed that a large number of the population became edentulous from the age of 30 years onward, particularly among females (53). It was found that 15.2% of males and 19.6% of females aged 35-44 years were edentulous and the percentages increased to 47.3% and 60.4% respectively for the 55-64 age group, the pooled prevalence being 26.2% (135). Although the incidence of edentulousness is declining over the years, in 1979 the overall prevalence among South Australians aged 15 years or more was still 23.3% (2). Causes of tooth loss in South Australia were investigated and periodontal disease was found to account for more than 50% of extractions in the 40-70 years age group (80).

Present knowledge supports the concept that periodontal disease is a preventable chronic disease primarily caused by the accumulation of bacterial plaque, and a host response

that is damaging to itself. Once established, it can generally be treated and periodontal health maintained by appropriate plaque control measures. Personal and professionally delivered hygiene can ensure that the disease is prevented and this study will examine the hygiene efficacy by extrapolation from the measured disease in the survey population.

South Australia is well served by dental manpower, with a dentist to population ratio of approximately 1:1750 in the metropolitan area (128). Government funded clinics and the School Dental Service provide free care to primary school children and those receiving social welfare benefits. Community surveys reveal that less than 50% of the population visit a dentist regularly (161). While there is a comprehensive central monitoring system to assess the effects of the School Dental Service on South Australian children (25, 136, 137), there is little information on the dental status of South Australian adults.

At a time when the question of dental manpower and rational planning of dental care delivery in South Australia are currently under investigation, it is appropriate that a well-documented survey of dental diseases be undertaken. Data on the periodontal status and treatment need of the population are particularly lacking.

The present study was undertaken in an attempt to

provide some of the needed information. It was essentially a descriptive epidemiological survey, with the aim of assessing the periodontal status of the study population and identifying group characteristics that might have influenced the occurrence and distribution of periodontal disease in the group.

Tooth mortality can be caused by other conditions besides peridontal disease, but tooth loss pattern was considered relevant as it might have some bearing on the observed periodontal disease pattern, and additionally has been suggested to be a reliable predictor of dental service utilization (72).

The specific objectives of the study were:

1. To determine tooth loss pattern and periodontal status of a defined adult population within the Adelaide Metropolitan area, by age, sex and socio-economic levels.
2. To establish their pattern of dental service utilization and oral hygiene habits.
3. To evaluate their perception of periodontal disease presence and need for treatment.
4. To assess their past experience of periodontal care, based on information obtained from the subjects.
5. To evaluate any association between periodontal status and the above factors.
6. To estimate the effectiveness of partial recording in periodontal disease assessment and generally assess the recently proposed W.H.O. community periodontal index (52).

It was felt that data from the study should show not only disease status but should be sufficiently comprehensive to provide a mathematical basis for the calculation of manpower and cost requirements for its treatment. Using locally prevailing resources and fee structure, it should be possible to convert the obtained data into approximate assessment of manpower and treatment cost requirement.

CHAPTER II

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REVIEW OF THE LITERATURE

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2.1 Summary of present knowledge on the etiology, pathogenesis and predisposing factors of periodontal disease.

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2.1 SUMMARY OF PRESENT KNOWLEDGE ON THE ETIOLOGY, PATHOGENESIS AND PREDISPOSING FACTORS OF PERIODONTAL DISEASE.

It is now generally accepted that periodontal disease is initiated by the host's response to microbial products of dental plaque situated within the gingival crevice. The situation can be likened to a host - parasite relationship, where a delicate ecological balance is maintained when the "parasite" comprises certain microbiota compatible with healthy periodontium, or the "host" is capable of tolerating the resident micro-organism. Any disturbance of the balance through changes in either the host or parasite, may result in the various expressions of periodontal disease.

The histopathological changes in the host tissue in periodontal disease has been described (119). The earlier changes involve an increase in junctional epithelium permeability and vasculitis with an outpouring of polymorphonuclear leucocytes (PMN). Intact chemotactic, migratory and phagocytic capacities of the PMN are presumably crucial if this first line of host defence is to be effective in restoring the ecological balance.

Indeed there is evidence to show that when PMN dysfunction exists, periodontal disease occurs in its rapidly destructive form. Such PMN dysfunction (chemotactic, migratory or phagocytic) have been observed in a large

percentage of patients with severe periodontitis, juvenile periodontitis and in certain systemic diseases known to be "predisposing" to severe periodontitis such as Chediak Higashi syndrome and diabetes mellitus (8, 99, 105, 163). The dysfunction may be intrinsic (i.e. genetically determined) or extrinsic (i.e. a response to certain bacterial factor/product) (34, 84). Preliminary results from Genco's laboratory suggested that a large number of Gram-negative organisms isolated from periodontal lesions could depress neutrophil chemotaxis in vitro (105). Similarly, when neutrophil numbers are depressed as in neutropenias, periodontal disease also tend to progress rapidly and destructively (145).

On the other hand there is evidence to suggest that the PMN - plaque interaction in the crevice activates intracellular lysosome release which could be detrimental to the integrity of the host cells and connective tissue structures, suggesting a possible causal relationship with the development of inflammation in early gingivitis (12).

Recently the role of vitamin C has been again discussed, both in enhancement of the effectiveness of crevicular epithelium barrier function and the chemotactic and migratory functions of the leucocytes (168).

It has also been shown that endotoxin, one of the most deleterious bacterial products in periodontal disease, accelerates tissue utilization of glucose resulting in temporary hyperglycemia which in turn decreases the

intracellular availability of transportable ascorbate, leading to lowered mucosal/epithelial barrier function and depressed chemotactic and locomotive neutrophil function (6). Vitamin C supplementation without removal of the hyperglycemia - inducing endotoxin would probably be of little value due to its impaired transport across cell membranes.

The microvasculature of the gingivae also exhibits one of the earliest changes in periodontal disease, becoming engorged, dilated, with increased permeability, resulting in outflow of serum and inflammatory cells. As the blood supply to the papillae is end-arterial microvasculature with no collateral support, such changes would seriously compromise the availability of nutrients to the gingivae and metabolic processes to utilize them. The situation is worse when other vascular disturbances are also present such as stress, smoking and the concomitant peripheral vascular constriction (35), or microangiopathy in diabetes (104), that more severe periodontal disease is often observed.

A feature of periodontal disease is the loss of connective tissue integrity with marked reduction in collagen content, and cytopathic alteration of fibroblasts. The highly increased demand for collagen turnover would presumably result in rapid depletion of the required restorative elements, particularly since the vascular supply is compromised, therefore it could be postulated that a state of "localised malnutrition" is induced.

The "early" and "established" lesion of periodontal disease (119) represents further tissue destruction, a host response misdirected and magnified by cell-mediated and humoral immune responses respectively. Because expressions of periodontal disease depends partly on the host response, any factors affecting the various arms of host response could presumably influence the signs of periodontal disease. Such "conditioning" factors have been discussed in several reviews (121). Epidemiological studies showed that immuno-deficient patients manifested lower level of gingival inflammation than matched immuno-competent persons (82, 131). As early gingivitis is reported to contain predominantly thymus derived lymphocytes (T-Cells) while the more advanced periodontitis lesion contains large numbers of B-lymphocytes and plasma cells, it is conceivable that humoral immuno-deficient patients may still exhibit some gingival inflammation as they can manifest normal T-Cell mediated cellular response. More pronounced difference might be expected with regards to advanced periodontitis (150).

Severe nutritional deficiency, particularly in protein and vitamin C, has also been shown to predispose to higher prevalence and severity of periodontal disease. However the concept of "localised malnutrition" within the periodontium in an otherwise healthy individual and its relationship with periodontal disease severity has not been explored.

Recent microbiological studies seem to lend credence to the specific plaque hypothesis (96) although no causal relations have been found. Nevertheless, the positive correlation observed between specific microbiota and certain types of periodontal disease did raise such possibilities (90, 91, 113, 154, 156). Certain bacterial species which predominate in the more destructive forms of periodontal disease have been postulated to be directly responsible for the severe destruction, if partly, rather than later inhabitants reflecting a suitable growth condition (34, 91). Specific antibacterial therapy have recently been tried with promising results (68, 97).

The findings that periodontally exposed cementum harbours endotoxin, and inhibits epithelial and fibroblast cells from reattachment in vitro led to a change in the rationale of periodontal treatment to render the root surface biologically acceptable again (13, 59, 81, 167). It seems that such treatment also induces a marked reduction of the pathogenic component of the flora for a period of time (155).

It would seem that a much improved likelihood for healing would occur if a two-pronged approach could be made, on the one hand by removing the "parasite" or converting it into a non-pathogenic microflora (if necessary by specific anti-bacterial therapy) and on the other hand by maximising the host's ability to affect repair (if necessary by tending to the "localised malnutrition" state).

2.2 THE INFLUENCE OF AGE, SEX AND SOCIO-ECONOMIC FACTORS.

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Man acquires many of the microbial genera which eventually comprise the adult oral flora in his first year of life. The flora is primarily aerobic, but with the eruption of teeth gradually a marked increase of the anaerobic component may occur. The maternal antibodies and foetal sensitized lymphocytes in neonate dissipate within about 6 months and immunocompetence is not fully established until approximately 3 years of age (85). It seems that by the age of 5 or 6, the immuno-microbiological ingredients for potential gingival inflammation are established. Apart from localized inflammation around erupting deciduous teeth, periodontal disease is generally not found in very young children. From approximately the age of 5 years onwards children with inadequate oral hygiene show a progressive increase in gingival inflammation, with a transient sharp rise in the early teens which seems to be associated with hormonal changes in puberty and occurs earlier in girls than in boys (160). From adolescence to old age there is a linear progression of periodontal disease severity which has been suggested to occur in a chronic and accumulative manner (95, 165) or in bursts of progressive damage (85). Data from epidemiological studies suggests that the maximum rate of increase in periodontal disease occurs at the age of 20-34 years or slightly earlier (85, 95, 152). By the second decade of life, early signs of destructive periodontitis are

sometimes evident and after the age of 40, advanced destruction is commonly seen. Age has been consistently found to be strongly associated with periodontal disease prevalence and severity, second only to oral hygiene. Greene and Vermillion showed that where good oral hygiene was maintained, no progressive increase in periodontal disease with advancing age was recorded (63). Other factors generally exert their influence indirectly, either by contributing to the accumulation or retention of the pathogenic plaque or by modifying the host response to the pathogen.

While the pattern of gingivitis seems to be similar in all parts of the world, destructive periodontitis occurs earlier in some developing countries. Russell reported whereas 3% of American youths aged 15-17 years showed early to established periodontitis, 5% of Lebanese and 10% of Palestinian children 10-14 years were affected (120). In Nigeria destructive periodontitis was commonly seen in youths 15-19 years of age with Acute Ulcerative Gingivitis and Cancrum Oris being endemic (151).

While extensive epidemiological studies failed to demonstrate definite association between nutritional status and periodontal disease (141, 165) it is hard to dismiss the hypothesis that severe malnutrition would considerably reduce host resistance and healing capacity. Data from some developing countries where severe malnutrition prevailed seem

to indicate that this was so (125, 165).

Sex accounted for a small difference of periodontal disease prevalence and severity found in most epidemiological studies. After puberty females tend to have less disease than males and this pattern continues through adulthood, the difference being usually attributed to better oral hygiene in females. In some developing countries however, females tend to show higher prevalence and severity. Waerhaug suggested that this may be due to the common state of malnutrition and frequent childbirth (166).

Racial differences in both severity and prevalence of periodontal disease have often been observed. Not only is the disease more prevalent in Asia and Africa than in Western countries, it is also more prevalent and severe in the black than in the white population of the United States. However Russell's study in Alabama indicated that educational level and socio-economic strata were more likely to be the influencing factors, rather than race per se (140). Nikias et al. screened 1,300 adults in New York City and correlated their health status with economic status, education and ethnic origin (114). Significant relationship was shown between the oral health status and each of the socio-economic characteristics. However, it was pointed out that economic status, education levels and ethnic origin were inter-related. Evidently, ethnicity was less important than economic status and education level and there was a stronger association between oral health scores and education than

economic status. The study revealed that decayed teeth ratio and restorative care levels were more strongly associated with economic status than education. It seems that the two variables, although highly correlated, do not measure the same thing. Higher education implies a greater knowledge and awareness of what appropriate dental care is, as well as socialization experiences and a style of life which incorporates appropriate dental care practices and habits. High economic status, on the other hand, implies greater ability to purchase dental care (restorative care), but not necessarily the socialization experiences. The relationship of ethnic factors to oral status was more complex. However, it was recognised that ethnic and cultural background were interwoven with economic and educational influences.

Other epidemiological studies have also shown periodontal disease to be more prevalent and severe in the poorly educated than in the well educated and in the poor than the wealthy. An extensive review of the literature by Richards and Barmes regarding the role of socio-economic status, and its principal concomitants (occupation, income and education) confirmed the findings (130).

2.3 DENTAL KNOWLEDGE, ATTITUDES AND BEHAVIOUR RELATED TO PERIODONTAL HEALTH AND PERIODONTAL CARE EXPERIENCE.

Perception of periodontal treatment needs have been studied by several workers, and the findings generally showed the majority of people were unaware that they suffered from periodontal disease and underestimated their need for periodontal care (129). Unlike caries, periodontal disease is rarely associated with pain and its signs are often not recognised as being pathologic until the disease is in its advanced stage. Clinical impressions suggest that many people have been aware of bleeding gums for long periods but discount it as a sign of disease. A study of Finnish young adults reported that even though clinically gingival bleeding was found in all subjects, only 2% were aware of their gingivitis despite the fact that as many as 46% had noticed gingival bleeding (3).

In New Zealand, although periodontal disease prevalence was presumed to be high, only small proportions of persons interviewed thought their dental health to be poor (24). Fanning and Leppard (57) and Fanning (56) studied several student populations and concluded that generally the public was unaware of their true dental needs. Review of the literature revealed however that even when people recognised that they have dental disease or were aware that they were susceptible to it, many did not regard this as sufficiently

serious to warrant action. People of various groupings have different beliefs of what constitutes appropriate dental health behaviour and these views are major determinants of the specific action they will take (130).

Australian studies also showed that generally the public are not practising ideal dental health behaviour although knowledge rates better (18, 19, 57, 132, 136).

Fanning and Leppard found that among University students, who have had better educational opportunities, regular dental care was only sought by approximately 50%, decreasing to about 30% among the older male students (57). Recent Australian Bureau of Statistics reported 44.8% South Australians aged 18-64 years had regular dental care at least yearly (161).

Various reasons for non-utilization of dental service have been investigated, the most often cited were cost, fear/dislike of dentistry, time factor, lack of awareness and unavailability of service. Fanning and Leppard found cost to be a deterring factor for 40-50%, followed by time (for about 30%), influencing regular care among the student population. Dislike of dentistry was given as an influencing factor by 19% male and 16% female students. Yet other studies reported costs to be responsible for a much smaller percentage of non-utilization (21, 69, 149), awareness of the need for care being a more weighty influence.

It seems that not everyone who is aware of periodontal disease would seek dental care, but it is even more unlikely that people would seek dental care if they perceive nothing wrong with their mouth.

Most people believe that oral hygiene plays a large role in the prevention of periodontal disease. Experimental gingivitis has been repeatedly shown to occur within a matter of days if plaque is allowed to accumulate, although further transition to periodontitis is a more complex phenomena. As interproximal areas are the most common site of periodontal disease, it follows that approximal removal of plaque is important but a tooth brush is relatively inefficient for this purpose and other aids need to be employed.

Surveys of oral hygiene habits generally show that most people brush their teeth, but only very small numbers regularly clean the approximal surfaces (20, 24, 115).

Periodontal disease prevention therefore depends on the promotion of increased awareness, more appropriate plaque control, better dental services utilization to prevent or treat it, and increased awareness among the dental care providers of its diagnosis and treatment.

Although there has been no specifc study of the extent of periodontal care delivery in South Australia, workers elsewhere have found that periodontal disease received only limited attention from the dental profession. Periodontal

therapy represented less than 3% of the total dental services rendered in the United States (48, 103). Bellini found it to comprise less than 6% of all dental services provided to a group of employees in Oslo (22).

Respondents in the 1979 Dental Health Survey in Australia stated that of all dental treatment provided to persons who saw a dentist in the previous 12 months, 39.8% was for "cleaning and polish" and 7.4% for "other" treatments besides check-up, restorations, extraction and dentures (46). If "cleaning and polish" and perhaps some component of "other treatments" can be considered as "periodontal treatment", this periodontal component constitutes a much higher percentage of the total dental care provision when compared to that in other countries. This implies that periodontal health among Australians may be better than is generally found elsewhere. Previous surveys did not support this notion. (39, 88, 112).

2.4 DEVELOPMENT OF THE PERIODONTAL INDICES

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Arthur Black, in 1918, was one of the first to attempt to measure the level of periodontal disease epidemiologically (109). Using a questionnaire and radiographic evidence, he found that 'this peridental infection' was rare under 20 years of age, and ranged from 13% in the 20-24 age group to 88% in the above 50 years age group. Other investigators prior to 1944 were also mainly interested in percentages of people affected by the disease. The methods used were generally arbitrary and subjective; the criteria commonly used were: 'mild, moderate and severe' or 'poor, medium and good', while others measured bone loss, using scales on radiographs or by the amount of gingival recession. These studies were useful as a guide, but were insensitive and precluded useful comparisons.

In 1945 King attempted to quantify the arbitrary criteria by giving them the following scores: normal : 0, light : +, moderate : ++, severe : +++.

Schour and Massler designed the original P.M.A. index (Papillary, Marginal, Attached gingivae), for a survey of gingivitis prevalence among Italian children in 1947 (102). After several modifications, the P.M.A. index was widely used for 20 years but it became largely discontinued when indices

with better qualitative features were developed (67).

Other numerical indices followed in an attempt to develop quantitative measures that were sensitive enough to detect the early signs of disease as well as the later stages, be reproducible, simple, inexpensive and amenable to statistical analysis (67, 109).

The first major series of epidemiological studies that included periodontal assessment were conducted as part of an extensive nutritional survey in many countries, under the auspices of the United States' Interdepartmental Committee on Nutrition for National Defence (I.C.N.N.D.). Similar surveys were organised by the Dental Unit of the World Health Organization (W.H.O.).

Russell's Periodontal Index (P.I.) was designed for use in the I.C.N.N.D. series of surveys, while Ramfjord's Periodontal Disease Index (P.D.I.) was initially prepared for the W.H.O. series. Russell designed his P.I. to provide quantitative comparisons between and within populations that were simple, reproducible and required minimum equipment in the field (139). He emphasised that P.I. was a field epidemiological tool and therefore not strictly suitable for clinical studies as it represented an underestimation of disease. This degree of underestimation, according to Russell, was uniform throughout the study groups, could be computed and was acceptable for epidemiological purposes (139, 144).

Russell's P.I. was extensively used in epidemiological studies in numerous countries, and was instrumental in the establishment of comparative world epidemiological data. This has often been cited as its major advantage, and the main reason for its continued use in later studies.

Average relationships between clinical diagnoses and P.I. values have been found as follows:

AVERAGE CLINICAL CONDITION	P.I.
Clinically normal supportive tissue	0.0 - 0.2
Simple gingivitis	0.3 - 0.9
Beginning destructive periodontal disease	0.7 - 1.9
Established periodontitis	1.6 - 5.0
'Terminal' periodontitis	3.8 - 8.0

Investigators who were concerned about treatment needs and therapeutics evolved different indices. Measuring criteria were adapted to satisfy specific answers in the quantification of periodontal disease. Later periodontal indices have been numerical, reversible, irreversible or composite indices. Reversible (morbidity) indices measure the reversible pathology and therefore reflect the success or failure of a therapeutic method. The P.M.A. and P.I. also have reversible components.

Irreversible (cumulative) index estimate total tissue damage over the life time of the individual; alveolar bone lost as a result of destructive periodontitis is the usual

basis for such indices.

Sandler and Stahl's Periodontal Disease Rate (P.D.R.), the ratio of teeth affected by periodontal disease (judged clinically and radiographically) divided by the number of teeth examined, was an irreversible index (146). Since bone loss is indicative of advanced periodontal pathology, indices relying on this criterion do not detect early changes of the disease.

Marshall, Day, Stephen and Quigley proposed a composite index in 1955, which required a detailed clinical examination, study models and colour photographs (120). It was a time-consuming index with little merit for population study, made worse by poor definition of some criteria and of the radiographic technique.

Ramfjord's Periodontal Disease Index attempted to compensate inadequacies of earlier indices and although P.D.I. was good for clinical studies, the index was cumbersome for field work (124).

O'Leary introduced a screening method that measured gingival and periodontal status, local irritants (e.g. plaque, calculus, deficient restorations) of six segments; 17 - 14; 13 - 23; 24 - 27; 37 - 34; 33 - 43; 44 - 47. All teeth were examined but only the tooth with the highest score in each segment was recorded (117).

The association between periodontal disease and oral cleanliness became clear by the end of the fifties and the need for an index to categorize oral hygiene status was expressed (62). Greene and Vermillion produced a precise and sensitive Oral Hygiene Index (O.H.I.) but it was slow with high examiner variability. It became the Simplified Oral Hygiene Index (O.H.I.-S.) in 1964, which like its predecessor was comprised of 'Debris Index' (D.I.) and Calculus (C.I.), but employed partial instead of full recording (64).

Löe and Silness introduced the Gingival Index (G.I.) to quantify gingival inflammation, based on their findings that colour changes of the gingival tissues were earlier signs than bleeding on probing (93). The G.I. criteria are: Score 1 for mild inflammation with no bleeding on probing, with Score 2 assigned when probing results in bleeding and score 3 for severe inflammation with spontaneous bleeding. Partial recording was adopted, using the following preselected teeth: 16, 12, 24, 36, 32, 44. In 1964 the same authors introduced a plaque index (PL.I) which recognised the significance of plaque in direct proximity of the marginal gingivae.

The Retention Index (R.I.) System was introduced in 1967 by Bjorby and Löe. It assessed the main retentive factors which encouraged bacterial accumulation in the gingival area, e.g. calculus, overhangs, caries, etc. (94). The G.I., PL.I. and R.I. system constitute a set of reversible indices valuable for screening the gingival conditions in children and adults. Large or small population could be sampled and

evaluated for therapeutic and preventive measures. Pathological changes in destructive periodontitis, were expressed in millimetres of pocket depth.

Mühleman and Mazor believed that bleeding from the sulcus was the earliest clinical sign of gingivitis, and introduced an index in 1958, originally called 'PM' (papilla and marginal gingivae) but later renamed the Sulcus Bleeding Index (S.B.I.) (110). They maintained that S.B.I. was more sensitive than Loe's G.I. system. The counting of bleeding points was considered to be a simple, reproducible rapid screening method, even with untrained examiners. However the use of a probe to elicit bleeding was criticised, even though a consequent study reported no significant correlation between probing force and the bleeding incidence (109). A study by Meitner et al. (107) supported the view that bleeding on probing was often an earlier indication of gingivitis than visual inflammatory changes. S.B.I.'s complex severity grading of six levels was its main disadvantage.

Ainamo and Bay felt that scoring of plaque and gingivitis should be made easy to enable patients to monitor their own progress in preventive or curative periodontics (4). Furthermore, most indices tended to use the individual as the unit of examination, usually yielding almost 100% prevalence. They suggested that the number of teeth or tooth surfaces affected in an individual was a better alternative. Such an index was proposed, Gingival Bleeding Index (G.B.I.),

based on the findings of bleeding on pressure with a periodontal probe or tooth brushing. The G.B.I. was found to have correlation to Loe and Silness's G.I. that was statistically significant.

A similar bleeding index was proposed by Carter and Barnes (31), that used dental floss instead of a periodontal probe.

Several workers were concerned that despite the various indices, a quick, effective appraisal of treatment needs was still difficult. It was suggested that epidemiological surveys had not addressed the need for treatment and had not proven to be an adequate basis for determining clinical needs (126). In addition, there were still many unknown factors concerned with the prevention and treatment of periodontal disease, and the type and extent of education needed for the personnel to carry them out. There was also the added problem of translating 'needs' to 'demands' for service.

Bellini (23) found no reliable association between numerical epidemiological parameters and treatment requirements or time evaluation. He felt that any planning for periodontal treatment delivery system must provide realistic pictures of the need for prevention and therapy, including estimation of manpower and resources involved. There should be an assessment that would clearly evaluate the treatment required, relating it to time and giving a basis for calculation of manpower and cost. In addition, it should

be simple and quick in field studies.

One system proposed was the Periodontal Treatment Need System (P.T.N.S) (79). The system was based on evaluation of the need for certain standardized treatments and the time required to perform them. They proposed a guideline of the time needed for each class of treatment, based on their particular situation and manpower of one dentist and one chairside assistant, to be approximately 60 minutes per person for class A (motivation and oral hygiene instruction), 30 minutes per quadrant for class B (scaling was also needed) and 60 minutes per quadrant when surgery was additionally required (class C).

In a similar study, Ekanayaka and Sheiham (50) estimated the time and personnel required to carry out periodontal treatment on patients in a dental hospital and in an industrial dental clinic. Their findings highlighted the dependency of such assessment methods upon the treatment philosophy adopted, the operator's skill, the facilities available and the patient's attitude.

Periodontal treatment need indices developed so far are still unsatisfactory, the main shortcomings being:

- the criteria are too subjective
- some treatment modalities require scientific longitudinal studies
- treatment philosophies differ
- demographic and behavioural data which may help predict 'treatment demand' have not been taken into account.

2.5 W.H.O. METHODS FOR PERIODONTAL ASSESSMENT 1961 - 1978

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Based on the recommendation of expert committees, over the years the W.H.O. has published several methodologies for the assessment of periodontal status for public health purposes. The main concern was to develop a sufficiently sensitive reproducible method that was practical in field studies.

In 1961 a W.H.O. expert committee recommended the use of Russell's P.I. as the basic measurement in epidemiological studies, and where additional information was required other indices might be employed as appropriate (122). In 1962 another committee found that inter-examiner reproducibility using the above method was low and recommended a simplified method (157). In 1965-66 a W.H.O. group concluded that while the 1962 method was suitable for public health simple prevalence surveys, more detailed methods were needed for descriptive and constructive epidemiological studies as well as clinical trials. Russell's P.I. was again recommended for constructive and descriptive epidemiologic studies. In addition, it was suggested that oral hygiene status be assessed as its relationship to periodontal disease was well established and needed to be accounted for when evaluating other factors. Greene and Vermillion's O.H.I.-S. was recommended as the index of choice. For clinical trials the

group recommended the use of Ramfjord's P.D.I. (41).

The promotion for uniformity in classification of oral diseases and anomalies was given further impetus with the publication of 'International Classification of Diseases Application to Dentistry and Stomatology' (I.C.D.-D.A.) in 1969, and revised in 1973.

In 1971, W.H.O. published a manual entitled Oral Health Survey, Basic Methods. (118) It was hoped that standardization of dental survey methods would facilitate the collection of global oral epidemiologic data. The chief purpose of the 'basic survey' was to provide reliable epidemiologic data for developing and conducting a regional or national dental health program. 'Elective' assessments were offered for those needing more detailed information. The elective assessments included Russell's P.I. for detailed periodontal disease assessment and Greene and Vermillion's O.H.I.-S.

The 1971 survey methods were used widely in more than 30 surveys (43), but the experience revealed some deficiencies. Davies, Horowitz and Wada (42) found that between examiner variability using the basic method was unacceptably high, although intra-examiner consistency was good in both basic and elective methods. They concluded that such survey results would be unreliable. The elective method was more reliable when the unit of study was a large group, but represented a gross underestimation on individual assessment

basis. Furthermore, results of the assessment of disease status and treatment requirement proved to be too crude for the need of most public health administrators (15). Recommendations of their modifications were discussed during 1973-1974 in Geneva, and the resulting draft was tested in 1975 during a W.H.O. course in Public Health Dentistry in Singapore and Malaysia (43). It was concluded that the proposed criteria for periodontal disease assessment resulted in gross underestimation of the disease prevalence. Ramfjord's P.D.I. and Russell's P.I. were considered unsuitable for public health surveys, and Loe and Silness's G.I. showed unsatisfactory examiner comparability and consistency. Ainamo and Bay's G.B.I. was considered a suitable alternative for gingival assessment, but it was rejected in its original form, as probing of gingival crevice in field surveys proved to be a controversial issue, sterilization being one of the major problems. A compromise criteria was proposed and a revised W.H.O. Oral Health Survey - Basic Method published in 1977 (118), while elective methods were to be included in a companion manual: "Guide to Oral Health Epidemiological Investigations" (16). As the system was designed for use by examiners with varying levels of training and experience, certain compromises were inevitable.

An attempt was made to assess the periodontal treatment need, however as it was based on the above assessment, the same degree of generality and compromise could be expected.

Cutress et al. (37) tested the method in a national survey of adults in New Zealand and found that Russell's P.I. permitted greater differentiation of periodontal status than the W.H.O. 1977 method. The latter lacked the averaging effect of measuring all teeth as in P.I., but provided a rapid appraisal of the volume of treatment needs and manpower requirements.

Late in 1977, a W.H.O. Scientific Group on 'Epidemiology, etiology and prevention of periodontal disease' met in Moscow. After detailed critical review of the current survey methods, a recommendation to use a different basic approach to the assessment of disease status and treatment needs was published in 1978 (52). The methods recommended were categorized according to the type and studies considered, with assessment of gingivitis, pocketing and number of erupted teeth comprising the basic data required for all types of studies.

The validity and reliabilty of certain aspects of the proposed method were yet to be verified, particularly the partial recording method, the value of gingival recession and calculus measurements.

2.6 COMPARISON OF PARTIAL AND FULL MOUTH RECORDING OF THE PROPOSED W.H.O. TECH. REP. SERIES 621 METHOD

The W.H.O. 1978 method, published in its Technical Report Series number 621, asserted that reliable diagnosis of periodontal pockets could only be made by probing. In an attempt to increase probing efficiency it was proposed that 16,21,24,36,41,44 (FDI notation) should be used as the representative teeth. Ramfjord stated that these six teeth provided an accurate assessment of the total periodontal status of the individual (124). The validity of this partial recording was later investigated by various workers (7, 33, 49, 77, 87). All agreed that the partial recording yielded Mean Scores that were statistically similar to full mouth scores. Downer (49) showed that partial recording was not capable of detecting all individuals with gingivitis or periodontitis in a prevalence survey. His study population was small, selective and the periodontitis experience in the group was low, casting some doubt on the validity of his finding.

The W.H.O TRS 621 methods are being tested by various groups in different parts of the world. Approximately 2000 recordings from 13 countries were available for statistical analysis, one of the tentative conclusions was that the partial recording method gave a "reasonable assessment" of the full mouth periodontal condition (51). However, further

analysis revealed that partial recordings gave a fairly good picture of severity but not of prevalence (5). Prevalence data of the various diseases are important parameters and are required if the treatment needs of a population are to be appropriately assessed.

2.7 PERIODONTAL DISEASE DISTRIBUTION

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2.7.1 EARLY PERIODONTAL SURVEYS

Along with the development of various periodontal disease indices in the late fifties and early sixties, there were numerous epidemiological studies of periodontal disease undertaken. Notably were those conducted under the auspices of the Interdepartmental Committee on Nutrition for National Defence (I.C.N.N.D.) of the United States, and other series organized by the W.H.O.

The I.C.N.N.D. surveys were carried out in Alaska, Ethiopia, Peru, Equador, Chile, Columbia, Thailand, Vietnam, Burma, Malaya, Uruguay, North-east Brazil, the West Indies, Jordan, Lebanon, Nigeria, Bolivia, and in the Blackfeet Indians in the United States (143). Comparison of the findings was made possible as the same survey methodology and indices were employed (Table II.1).

A National Health Survey of the United States adult population was carried out during 1960-62 (Table II.2). The Dental Division of the W.H.O. conducted similar studies in Sudan, Iran, Ceylon, Nigeria and India (Table III.3) (125, 143). Other periodontal surveys using a diversity of methods but yielding corroborative qualitative results were carried out in other parts of the world, including Canada, various parts of the United States, Norway, Islands of the Western Pacific, Israel, and Australia.

Table II.1 Average P.I. of civilians aged 40-49 in various countries (143).

Population group	P.I. (average)
Baltimore (white)	1.03
Colorado Springs	1.04**
Alaska - primitive Eskimo	1.17*
Equador	1.85
Ethiopia	1.86
Baltimore (negro)	1.99
Vietnam	2.18
Colombia	2.21
Alaska - urban Eskimo	2.31*
Chile	2.74
Lebanon	2.98
Thailand	3.30
Lebanon - Palestinian refugees	3.52
Burma	3.58
Jordan civilians	3.96
Vietnam - Hill tribesman	3.97
Trinidad	4.21
Jordan - Palestinian refugees	4.41

* Males only ** 40-44 only

Table II.2 Periodontal status, by age and sex, U.S. 1960-62 (from Johnson, Kelly and van Kirk 1965), in (143).

Age	Average P.I.	% with pockets	Average O.H.I.-S.
Men			
18-24	0.62	10	1.5
25-34	0.92	22	1.6
35-44	1.27	30	1.7
45-54	1.62	37	1.9
55-64	2.15	46	2.1
65-74	2.50	58	2.5
75-79	2.91	60	2.2
Women			
18-24	0.48	10	1.2
25-34	0.60	12	1.2
35-44	0.82	21	1.2
45-54	1.23	30	1.5
55-64	1.56	36	1.6
65-74	1.62	33	1.6
75-79	2.94	54	1.9

Table II.3. Average P.I. in countries surveyed under the W.H.O. sponsorship (143).

Age	Ceylon		Sudan	Iran	India
	village	Urban			Rural
5-9			0.99		
10-14	0.65		1.40	1.49	
15-19	0.84		1.23	1.30	
20-29	1.64	1.38	1.76	1.94	1.53*
30-39	3.06	2.34	2.42	3.00	
40-49	4.36	3.49		3.37	
50-59	5.23	4.07			
60+	5.97				

* Aged 19-30

2.7.2 SOME EUROPEAN SURVEYS

Several surveys in Great Britain found severe periodontal disease to be highly prevalent and was generally untreated (152, 153).

More recently an epidemiological survey of periodontal disease in Dutch adults was carried out in five regions of the Netherlands (123). 1,337 randomly sampled employees were examined by calibrated examiners, using the W.H.O. 1977 survey methods with slight modification. A summary of their findings is presented below:

Of the population examined 19.8% were edentulous, ranging from 3.9% in the 15-24 year olds to 64.7% in the 55+ age group, while calculus deposit was found in 79.3% and 100% of the two age groups respectively. The prevalence and severity of "intense gingivitis" increased with age, lower levels of education, and there was a tendency towards lower levels of gingivitis among females. One or more periodontal pockets of 3mm or deeper were found in 53.3% of all dentate population (60.9% of males and 46.5% of females), increasing with age to 81.8% in the 55+ age group. Pockets of 6mm or more were found in 10.1% of the study population. The authors noted that whereas the W.H.O. 1977 criteria were practical and reliable for the assessment of prevalence and severity of periodontal disease, the assessment of treatment need left much to be desired.

Hansen and Johansen surveyed 177 randomly sampled 35 year old citizens of Oslo, Norway (66). The periodontal status was assessed according to Russell's P.I. and the P.T.N.S. (Periodontal Treatment Need System), additionally the subjects completed a questionnaire regarding dental care. Despite the fact that Oslo had a high dentist/population ratio (1:589) and 88.9% of the sample visited a dentist

regularly, periodontal disease was found to be highly prevalent.

The P.I. was 1.30 for the total sample. Only 1.7% were in no need of periodontal therapy as assessed with P.T.N.S. (Class 0); 7.7% needed motivation and oral hygiene instruction only (Class A); 53.0% needed scaling in one or more quadrants (Class B); 37.6% required surgical treatment (Class C). All persons examined performed oral hygiene procedure regularly; the majority (77.8%) brushed more than once a day. However, the frequency of brushing was found to have no influence on their periodontal condition. Although 88.9% had regular dental checkups, only 12% reported that they had had periodontal treatment. No statistically significant differences were found in the findings among different sex and education groupings, however the age group and the small sample may account for this.

Using estimates given by Finnish periodontists, Markannen adapted the P.T.N. system to survey a group of 300 factory workers, whose mean age was 33.2 years (100). Of the total estimated treatment need, 30% of time was required for motivation and oral hygiene instruction, 63% for scaling and removal of overhangs and 7% for surgery. The mean estimate of periodontal treatment need was 97 minutes per person and 32 minutes per dentulous jaw segment.

2.7.3 PACIFIC AREA

The people of the Pacific Islands who were still widely dispersed in 'closed' population groups, provided an

appropriate study of etiology and ecology of dental diseases.

Early surveys of periodontal disease in the Pacific people revealed its wide prevalence and distribution. Destructive periodontitis was commonly observed amongst young adults, the severity increasing with age. All older adults examined were affected, except those from Manus and Fiji (29). Table II.4 shows some of the findings. Periodontal disease was not confined to those in close contact with European civilization (e.g. Nauruans); it equally affected those isolated from the European influence at the time of investigation (e.g. Puka-puka).

Barmes reviewed dental surveys of Polynesian, Micronesian and Melanesian groups in the Pacific Islands to compare the pattern of dental disease in these 'primitive' societies with data from Europeans (14). Most of the surveys were done before periodontal disease indices were developed. He concluded that lack of precise criteria for disease measurements, haphazard sampling, disregard for age distribution and lack of examiner's calibration, contributed to invalidation of any comparability, particularly with regard to periodontal disease pattern. Barmes emphasized the need for standardization of indices and method, and careful handling of age distribution.

Well designed and documented base line surveys of periodontal disease pattern in these people would have given valuable data towards the understanding of sound concept of

'normality' in the life cycle of human dentition.

In 1971, a joint W.H.O. and South Pacific Commission seminar in Noumea reviewed the state of dental diseases in the South Pacific. Subsequently, Masi reported that periodontal disease was highly prevalent and constituted a public health problem, throughout the entire region (101). Prevalence of calculus was widespread even in young children. Periodontal disease was reported to be more prevalent in urban areas and least so in remote rural areas. The situation seems to be worse in American Samoa, where 100% of the 30-34 year age group had periodontitis and 33-82% had pockets deeper than 6 mm.

Table II.4 Prevalence of periodontal disease* in the Pacific area (from Cadell, P.B., (103) 1960).

Territory	Author	Year reported	Age	Prevalence
Fiji	Davies	1948)	3-20	31
		1949)	adults	50
Nauru	Cadell	1959	11-20	40
			21+	96
Manus	Kirkpatrick	1937	all ages	48
Papua New Guinea	Cameron and Sinclair	1947	16-29	29
			30+	91
New Guinea	Williams	1958	10-15	67
Puka-puka	Davies	1956	11-20	21
			21-30	61
			31+	93
Raratonga	McDowell	1953	5-10	22
			11-15	80
Raratonga	Faine and Hercus	1951	21-40	86
			41-50	100
Western Samoa	Williams	1939	5-10	54
			13-24	75

* The term 'periodontal disease' includes all stages, from early gingivitis to terminal periodontitis.

2.7.4 ASIAN AREA

Moreira reviewed the result of two series of surveys organised by I.C.N.N.D. in the 1960's and W.H.O. in the 1970's (108). Russell's P.I. and Greene and Vermillion's O.H.I.-S. were used in the I.C.N.N.D. series, the W.H.O. criteria (157) or its adaptations were utilized in the W.H.O. surveys. Although the data may not be strictly comparable, in each series uniform criteria and methods were used and examiners were calibrated.

A National Dental Health Survey of Singapore school population aged 6 - 18 years in 1970 showed a moderate to high level of periodontal disease prevalence and revealed different levels of severity among the three ethnic groups examined, the Malays being the worst affected, followed by the Indians and the Chinese (60).

A similar survey in West Malaysia showed a lower prevalence of gingivitis among 6 - 11 year olds and mean P.I. scores of 0.17 among the 15 - 19 years group. The P.I. scores rose steadily with age up to 1.33 among the 40 - 44 years age group and then increased sharply to 4.48 for those aged 55 or more (108). Majid and Abbas found a higher prevalence of gingivitis (96.6%) among 12 year old Malay school children (98). A dental survey of 4,707 persons aged 3 - 54 years in Hong Kong in 1967-68 revealed approximately 47% of adults had periodontal pockets deeper than 3 mm. The examiners found that less than 1% of adults had teeth

indicated for extraction due to periodontal disease, implying that the disease may have been "contained" or inactive in the largely Chinese population (108).

In the Phillipines, the prevalence of periodontal disease was found to be slightly lower than in other Asian countries. Periodontitis affected 3.3% of the 20 - 24 year olds, the percentage increased with age up to 48.1% among those aged 55 years or more (108).

Thailand and South Vietnam showed some of the highest mean P.I. scores with approximately 60% of male citizens exhibiting pocket formation and destruction of tooth supporting structure (Table II.5) (142). Ramfjord, using P.D.I., and Greene, using P.I. and O.H.I.S., conducted the W.H.O. oral health survey in India during 1957 and confirmed previous findings in that almost 100% of persons examined had periodontal disease (125). While true pocket formation was rare before the age of 15 years (3%), the rate of periodontal destruction seemed to go unabated from then on so that by the age of 17 years, 12% exhibited periodontal pockets and the severity continued to increase throughout life. Calculus formation was found to be heavier than was generally seen in Western populations.

In a longitudinal study of the natural progression of periodontal disease by Löe et al. a group of Sri Lankan tea labourers were serially examined over a period of more than 8 years (95). Generally, early and severe manifestations of

periodontal disease were observed. Approximately 30% of 15 year old Sri Lankans showed loss of periodontal attachment measuring between 2-9 mm. The disease progressed continuously at a relatively even pace, and by 40 years of age this group had lost approximately 30 to 35% of the total periodontium.

TABLE II.5 Average P.I. scores by age in South Vietnam and Thailand (141, 142).

AGE	THAILAND	SOUTH VIETNAM
15-19	0.41	0.53
20-29	0.72	0.66
30-39	1.97	1.53
40-49	3.06	2.62
50+	5.54	4.59

2.7.5 AUSTRALIA

There is a paucity of data on periodontal status of the Australian adult population. Quite a number of surveys on school children have been done; adult surveys, however, have been confined to special groups such as the Armed Forces.

Barnard and Minns organized a survey involving 1,354 subjects randomly sampled from the Sydney metropolitan area (18). The data collected included periodontal status according to W.H.O. 1971 method. The examination was carried out by more than 100 dentists who were given written instructions but not calibrated, and the results on periodontal status were unpublished.

Lilienthal, Amerena and Gregory examined 854 dental patients in several Melbourne suburbs (88). The group was chosen to yield samples from upper middle, lower middle and working class populations. They found that none of the following parameters had statistically significant effects on the P.I. scores: race, skin colour, education level, occupation and smoking habit. Toothbrushing frequency, however, was significantly correlated with it. The scores by age are presented in Table II.6.

Table II.6 Average P.I. and O.H.I. scores of dental patients in Melbourne (88).

Age	Mean P.I.	Mean O.H.I.
5-14	0.63	0.66
14-24	1.00	1.08
25-34	1.45	1.61
35-44	2.07	1.91
45-54	2.72	2.10
55+	2.49	2.21

Dale studied the prevalence of caries and periodontal disease in a group of 17-29 years old Regular Army troops and National Service conscripts (39). He found slightly less prevalence and severity of periodontal disease compared to civilians studied by Lilienthal et al. He also noted the close association of periodontal disease with age and oral hygiene.

Newcomb assessed the periodontal treatment requirements of randomly sampled 187 defence forces personnel (112). He used a "Periodontal Treatment Requirement" (P.T.R.) Index, which, similar to the Norwegian P.T.N.S., related the treatment to a specific situation.

Segmental recording of the index, based on clinical and radiographic examination of all teeth, was done. P.I. and O.H.I.-S scores were also taken. The mean P.I. of the group was 1.49 with individual scores ranging from 0.2 to 6.6. The mean O.H.I.-S scores was 1.85. Using the P.T.R. Index, he found that none had all six segments free of periodontal disease. P.T.R. scores no greater than 1 was found in 38.5%, which represented "oedematous gingivitis and/or calculus", requiring scaling, polishing and oral hygiene instruction. About 40% had P.T.R. scores of 2 and 3 which represented "fibrous gingivitis" and "early periodontitis" respectively, and according to the index, these groups needed simple periodontal surgery, involving an average of 2 segments per person. 22% required more complex surgery (P.T.R. scores 4 and 5), involving an average of over 3 segments per person.

Analysis of the overall P.T.R. of the group showed that 53.6% of all segments required only scaling and improved plaque control. The author emphasised the value of the dental hygienist in the provision of treatment. It is not possible to extrapolate these findings to the general population but it may be reasonable to assume that it is unlikely that the adult civilian populations would have any better periodontal health than the medically fit and predominantly young defence personnel.

A Dental survey in Busselton, Western Australia, examined 892 people aged 21 - 39 years in 1978 and revealed the most prevalent treatment need to be "prophylaxis and oral hygiene instruction" (65%) for mild periodontal disease (106).

An international collaborative study under the auspices of the W.H.O. examined a small sample of adults in Sydney, using a slightly modified P.I. (17). The periodontal disease status was found to be moderately low, with average P.I. scores of 1.10 for females, 1.37 for males, 1.19 and 1.26 for metropolitan and non-metropolitan dwellers respectively. As far as can be ascertained there is no comprehensive periodontal epidemiological data on the general population of white Australians.

Studies on the dental status of the Australian Aborigines have been more frequently documented in the literature and the periodontal findings of some of these are presented. A series of studies on Central Australian

Aborigines in Yeundumu Settlement, near Alice Springs, reported that 58.5% of the 103 persons examined in 1955 had gingivitis, which was generally "mild" (36). Two main types of gingival condition were described as hyperplastic gingivitis associated with lower anterior crowding in younger subjects, and limited marginal gingivitis associated with small amounts of calculus around a few teeth. The age group of the population sample were not mentioned.

Examination of pre-white Aborgingal skulls resulted in the observation that, although there were "signs of mild gingivitis" (early periodontitis?), there was no evidence of extensive recession of alveolar crest (36). No age estimation accompanied the observation.

Previous expeditions to the same settlement noted the changing nature of life style and dietary pattern of the population in the settlement (30). The authors observed that the children's gum margin showed definite signs of "marginal irritation". However, after having "gone bush" for a few months and resuming the more traditional dietary pattern, those same children showed definite gingival improvement.

The general observation made at the time seemed to suggest that the Australian Aborigines who still led a nomadic life style and retained their traditional diet, had healthy teeth and supporting structures. Moody similarly reported of the Aborigines at settlements in Arnhem Land in

1948 and 1949: "... despite an almost complete absence of toothbrushing oral hygiene was remarkably good, calculus formation rare, although there was generalized advanced peridontal destruction in the older group" (73).

This appears to be in contrast to findings in other similar societies where periodontal disease was consistently found to be a severe problem. It is unfortunate that those earlier studies lacked definitive and quantitative assessment of periodontal disease.

While it is unwise to make direct comparison without similar assessment methods and consideration of other relevant variables, it remains an interesting observation that a particular ethnic group, the pre-white Australian aborigines, was reported to be relatively free from a disease which so universally inflicts other populations.

A cursory look at more recent studies on Aboriginal population gave the impression that generally periodontal disease prevalence was found to be much higher (Table II.7). The implication was that this was a manifestation of their changed life style and environment (74). It is likely, however, that more precise methodology may have been responsible.

Table II.7 Studies of periodontal disease among Australian Aboriginal people (adapted from Homan, 1977)(74).

Authors	Year	No	Age	Comments	Prevalence %
Campbell	1939	350	All ages	No artificial oral hygiene. Infrequency of marked periodontal lesions	50
Moody	1949	1557	All ages	Generalized gingival hypertrophy (?) is universal	100
Barrett	1953	224	All ages	Chronic gingivitis was more general in adults	?
Cran	1957	103	?	A very limited marginal gingivitis	59 (1955) 43 (1956)
Reade	1965	171	All ages	Little evidence of gross periodontal pathology even in aged individuals	?
Homan and Davies	1973	307	6,8,10 12 and 35-44	Prevalence and site-prevalence of periodontal disease was high	94-100
Stockwell	1974	?	?	General lack of periodontal disease in spite of low standard of oral hygiene	?
Yule	1975	167	4-15	Periodontal scores were high	84
Homan	1977	202	6 age groups 6-49	Very high prevalence in all age groups, more severe with with increasing age	Almost 100
Schams-chula et al	1980	83	16-70	Very high prevalence, the severity increased with age PI range from 1.7 in 16-23 yrs. to 4.8 in > 50 yrs.	92

The world wide survey demonstrated the ubiquitious nature of periodontal disease. No race has been reported to be entirely free from it. In contrast to dental caries, which is a recent phenomena, evidence of periodontal disease has been found in the skull of ancient man, and it has continued to afflict man since then.

Subramanian, in 1951, reported periodontal disease to be the cause of 69% of extractions among hospital patients in India. Mehta reported similar findings in 1958 (120).

A survey of nearly 40,000 dental patients conducted by the American Dental Association in 1952 showed that for males aged 35 years and over, and females aged 40 years and over, periodontal disease was the reason for two to three times as many extractions as dental caries (120).

Roder projected findings of tooth loss in South Australia's population (135). He found that 1.3% of 15-24 year olds were edentulous, increasing to 17.4% in the 35-44 age group and 77.8% for the 65+ age group. A study of the causes of tooth loss in dental patients in South Australia found that 25.6% of extractions in all age groups were due to periodontal disease (80). In the 40-70 year old patients, more than 50% of tooth extractions were due to periodontal disease.

Generally, in developed countries, where caries experience is high, periodontal disease and caries account

for about the same amount of total tooth loss. As the effect of water fluoridation and other preventive measures become manifest, the number of teeth exposed to the risk of periodontal disease will increase markedly.

CHAPTER 3

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MATERIAL AND METHOD

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3.1 The study population.

3.1.1 Selection of the study population.

3.1.2 Profile of the study population.

3.2 The questionnaire.

3.2.1 Ethnic grouping.

3.2.2 Sex grouping.

3.2.3 Age grouping.

3.2.4 Socio-economic status.

3.2.5 Dental service utilization.

3.3 The oral examination.

3.4 Partial recording assessment.

3.5 Examiners' calibration.

3.6 Survey organization and procedure.

3.7 Treatment of the data.

3.1 STUDY POPULATION

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3.1.1 SELECTION OF STUDY POPULATION

The initial intention was to study a sample of adult population of the Adelaide Statistical division, an area that incorporates approximately 70% of the state's adult population. As resources were extremely limited, it was not possible to randomly sample the whole population, a "convenience" sample was therefore sought. The following study populations were considered:

- The armed forces - members of this group were medically fit, were provided with free dental treatment, and were considered to be a non representative population.
- Random selection from the telephone listing was met with abysmally poor response.
- A large organization with members drawn from diverse socio-economic backgrounds agreed to involve its community but response was very poor.
- It was not possible to associate with any of the programs of the Community and Preventive Medicine Department of the University of Adelaide or the Dental Health Branch of the S.A. Health Commission.
- Outpatients from Ophthalmic clinics at the Royal Adelaide Hospital and a private practice were considered suitable, as eye disorders affect a wide age range, are not sex related and do not affect the course of periodontal disease except perhaps indirectly in diabetic retinopathy. It could be argued that the percentage of patients suffering from diabetes retinopathy may reflect that of the general

population and therefore need not be a source of bias.

- Employees of Government Departments or Industrial groups were also considered suitable.

A pilot survey was carried out and 25-44 years old patients from the ophthalmic clinic were chosen as the study population. The pilot survey served as a trial for the design, organization, procedure and requirements of the survey and several minor alterations were made to the survey format at that stage.

Employees of an industrial company were selected as the "convenience" study population for the main survey. The management of General Motor Holden Company agreed to host the project, but only voluntary participation was allowed. After discussion with the Company's Medical Superintendent and Personnel Officer, multiple "Staff & Factory notices" were issued to all employees, which explained the forthcoming survey and urged employees to participate.

Voluntary participation and sampling control required reconciliation and considerable effort was made to reduce population bias in the main survey, by repeated invitations and discussions with plant supervisors who in turn encouraged their team members to participate. The examiners also made concerted attempts to provide counsel and advice with optimal empathy to encourage greater participation, and free tooth brush, toothpaste, dental floss and pamphlets were provided. It is assumed that participation in the main survey was

equivalent to a simple random sampling of the company population.

The relevant background variables were recorded and in this way the study population was defined with regard to ethnic grouping, age, sex and socio-economic status.

3.1.2 PROFILE OF THE STUDY POPULATION

A total of 680 employees participated in the study, the 512 male and 168 female participants were a good cross-section of the Company's population with respect to age, sex and occupation (Table III.1). Distribution by age and sex of dentate and edentulous subjects are shown in Table III.2 and socio-economic distribution in Table III.3. The small number of female and high socio-economic participants accurately reflected the company's composition. The mean age of the participants was 38.4 years for females and 37.8 years for males.

The percentage of edentulous subjects was low in comparison to the general community (46, 135) and was probably an under-representation of the edentulous population within the company. The 38 edentulous subjects were excluded from further detailed analysis as their pattern of dental behaviour would be quite different from those of the dentates (27, 72) and their numbers too small for separate analysis. Their oral examination data were not relevant to the present study.

Approximately half of those surveyed considered themselves to be "Australian", the other half were comprised of British, European and other ethnic groups (Table III.4). Compared to the general population of Adelaide, the present group has a larger component of "non-Australians".

Table III.1 The ratio of survey participants to the company population, by age, sex and occupation.

BY AGE		BY SEX		BY OCCUPATION	
Age	Ratio#	Sex	Ratio#	Occupation	Ratio#
17-24	16.7	M	14.1	Upper	18.5
25-29	21.1	F	26.4	Middle	34.8
30-34	18.8			Lower	13.8
35-39	16.1				
40-44	23.0				
45-64	11.6				
All ages	16.0				

The percentage of the study population from equivalent sub-groups in the company's population.

Table III.2 Population distribution by age and sex.

AGE (YEARS)	DENTATE M	DENTATE F	EDENTULOUS M	EDENTULOUS F	TOTAL
17-24	95	21	-	-	116
25-29	69	21	-	-	90
30-34	60	16	-	-	76
35-39	46	12	4	2	64
40-44	69	50	1	6	126
45-64	149	34	19	6	208
ALL AGES	488	154	24 (4.7%)#	14 (7.7%)#	680

percentages within males and females subgroups.

Table III.3 Population percentage distribution by socio-economic status (S.E.S.).

	S.E.S. INDICATOR		
S.E.S.	OCCUPATION	INCOME	EDUCATION
Upper	5.1	17.2	8.2
Middle	20.4	59.9	43.1
Lower	74.4	22.1	48.1
N.A.	-	0.8	0.5

N = 680

N.A. = no answer/not applicable.

Table III.4 Population distribution by ethnic groups

ETHNIC GROUPING	MALE	FEMALE	ALL
Asian	-	2	2 (0.3)
Australian	288	47	335 (49.3)
British	64	91	155 (22.8)
European	158	27	185 (27.2)
Others	2	1	3 (6.4)
TOTAL	512	168	680

Percentages in parenthesis

3.2 THE QUESTIONNAIRE

****

A questionnaire was carefully designed to obtain the desired information. To simplify the subjects' task and reduce the non-response rate, a multiple choice format was used for all but one open-ended question. The questionnaire was self-administered to avoid interviewer's bias and influence (1).

Issues addressed in the questionnaire were socio-demographic data, pattern of dental service utilization, oral health habits, periodontal care experience, perception of periodontal disease and its treatment need (Appendix 1).

3.2.1 ETHNIC GROUPING

Disparity in periodontal disease prevalence and severity has been observed in different ethnic groups, although it is generally believed that educational and socio-economic levels are more likely to be the influencing factor rather than ethnicity per se. The decision to classify the survey population by ethnic grouping had to be considered if they differed significantly from the general community ethnic composition.

During discussion with the Company's Personnel Officer it was indicated that many of their employees were new immigrants and ethnic groups were therefore categorized into

Asian, Australian, British, European and 'others'. As some language difficulty might be encountered, translations of the survey forms in to Greek, German and Italian were made and two of the survey staff were multi-lingual. Ethnic grouping had not been done for the pilot survey as preliminary enquiry revealed no distinctly different pattern of ethnic groups among the clinic population compared to the general community.

3.2.2 SEX GROUPING

Studies in developed countries tend to indicate that females generally have a more favourable health behaviour and slightly better periodontal health than males although the findings have been inconsistent. On the other hand, earlier studies in developing countries recorded the opposite observations and Waerhaug suggested that the frequent childbearing and the common state of malnutrition might have been contributing factors (165). Because sex may be associated with periodontal disease pattern and dental behaviour it was decided to include sex as a background variable.

3.2.3 AGE GROUPING

Periodontal disease has consistently been shown to be more prevalent and severe with increasing age. The age range between 25-44 years is of interest since there has been sufficient exposure time to allow the establishment of periodontal disease (i.e. morbidity) but insufficient time to result in widespread tooth mortality. In the present study this age range was subdivided into 4 equal age groups: 25-29, 30-34, 35-39 and 40-44. Those younger than 25 years and

older than 45 years were generally assumed to be reasonably homogenous with regard to periodontal disease destruction and the amount of tooth loss to justify open ended age groupings.

3.2.4 SOCIO-ECONOMIC STATUS

Socio-economic strata has often been associated with the prevalence of periodontal disease. Its influence is generally considered to be indirectly exerted through the concomitant increase of awareness of better oral health practices in the higher strata. Three commonly used indicators of socio-economic status were employed: occupation, education and income.

Richard & Barmes, in an extensive review suggested that education appeared to be more closely related to oral health than occupation or income level (130). "Education level" in the present study was measured as the individuals' own experience because it implied internalization of concepts. Occupation and income, on the other hand, signified more the ability to purchase dental care rather than necessarily, the socialization experience and awareness of the principles of better oral health practices. The breadwinner's occupation and total family income were seen as the appropriate indicators, which applied to all members of the family. The three indicators do intercorrelate (114), and by measuring all three it was hoped to gain a more appropriate socio-economic stratification. A question on income level may be frequently left unanswered, when the occupational and educational status might be relied upon to provide the

socio-economic indicators.

The socio-economic index used in the present study was formulated with some difficulty, and the stratifications were generally arbitrary.

It was endeavoured to use similar measures as those used by the Australian Bureau of Statistics (116) for occupational strata, although the Bureau's classification was not based on stratification of social or economic status. It was based on occupational characteristics such as the function involved, training required and type of material worked on. The major nine occupation categories were condensed into three occupational levels. The levels were designated "executive level, white collar and blue collar workers" in the pilot survey.

For the main survey, assuming that most of the participants were breadwinners, the Company's relatively simple occupational hierarchy was used as a basis for the occupational index, which in turn can be related to the occupational classification used by the Australian Bureau of Statistics. The "upper" occupation level includes managerial positions (from general foreman to executives), the "middle" level corresponds to factory supervisors and office workers and the "lower" level covers factory workers.

Using the State's minimum award rate and the seasonally adjusted median and average income levels at the time of the

survey, arbitrary income strata were drawn. For the pilot survey the income level index was therefore "upper" for those whose annual income exceeded $15,000, "middle" for $8,000-$15,000 earners,"lower" for those earning less than $8,000, and the upper and lower boundaries adjusted to $17,000 and $10,000 respectively for the main survey.

The educational index categorized the first ten years of schooling or less as "lower" level. The "middle" level was intended to cover further training such as technician and trade certificate courses and "upper" level represented a completed tertiary education or its equivalent.

3.2.5 DENTAL SERVICE UTILIZATION, ORAL HYGIENE AND PERIODONTAL CARE

In addition to the above demographic data, issues addressed in the questionnaire were:

- the time interval since the last dental visit.
- the regularity and frequency of dental visits.
- the main reason for non-utilization of dental service.
- oral hygiene habits.
- past experience of periodontal care.
- the subjects' own perception of periodontal disease and treatment need.

Selected questions were worded as in the W.H.O. service-utilization survey format (118b) and the dental sections of National Health Surveys conducted by the Australian Bureau of Statistics (9, 11).

Question 7 of the Questionnaire (see Appendix 1) attempted to measure the subjects' actual use of dental service facilities: "How long ago did you last see anyone about your teeth and gums?" The term "anyone" was chosen, to include dental personnel other than dentist. The next two questions examined the regularity and frequency of dental visits. Question 10 was addressed to those who had not obtained dental care within the preceding 12 months. Oral hygiene habits were dealt with in question 11 and 12.

Question 13 was designed to assess whether or not periodontal disease had been diagnosed in the past. The answers need to be viewed with caution as they rely on the subjects recollection or interpretation of their dentists' clinical findings, and the assumption that their dentist informed the patients of their finding. In periodontal care, it is imperative that the patient be made aware of the disease presence as treatment depends largely on his involvement in assuming responsibility for plaque control. Therefore question 13 was considered a valid means of assessing periodontal care delivery. Question 14, asking whether or not treatment was obtained if periodontal disease was diagnosed, was also based on similar approach as question 13. The subjects' perception of disease presence were assessed in question 15 and their desire or intention to obtain treatment, a further step towards actual service utilization, was also assessed.

The final question was an open-ended one, dealing with

the type of dental treatment the participants thought they needed. The answers were later coded into checkup, restorations, extractions, dentures, "scale and polish" and "others".

3.3 THE ORAL EXAMINATION

****

The principal objective of the oral examination was to determine the teeth present, the periodontal status and treatment requirement of the subjects as a group, in descriptive epidemiological form. The study assessed the most common form of periodontal disease, chronic gingivitis and periodontitis.

The epidemiological method used was published in a W.H.O. Technical Report Series no. 621 and is referred to as the TRS-621 method (52). The method was slightly modified as described and a full mouth recording method was adopted from which partial recording accuracy could be analysed later. FDI notation was used in the examination form, which is shown in appendix 2.

3.3.1 GINGIVITIS

Gingivitis was assessed using a bleeding index: score 0 for no bleeding and score 1 for its presence, on gentle interproximal probing of the gingival crevice or pocket until the resistance of the dentogingival fibers was felt.

The use of bleeding index obviated the need for standardized lighting required for visual assessment of gingivitis (e.g. colour, consistency), and such index has been shown to be a good clinical measure of early gingivitis as well as indicator of active periodontal inflammation. The counting of bleeding gingivae was simple, and had the

potential to increase examiners' consistency. Gingivitis was considered to be a good estimator of the efficacy of the usual oral hygiene regime whereas plaque score, only indicated the amount of plaque present at the recording time. Moreover, individual host resistance is not taken into account when using plaque scores, whereas it is inherent within the measurement of gingival inflammation.

The bleeding assessment was recorded after probing for pocket depth measurement in each quadrant. However, if bleeding was profuse, it was recorded directly. The two sulci in each interproximal area were considered as one unit and recorded against the tooth distal to it. This method allows the extraction of partial recording data prescribed in the TRS-621 report.

3.3.2 PERIODONTITIS

The measurement of periodontitis was achieved by quantifying the periodontal pocket. The method adopted measured the base of the pocket from the gingival margin on the four aspects of all standing teeth except third molars. In the maxilla, the assessments of mesial and distal surfaces were made from the buccal aspect, in the mandible they were made using a lingual approach.

The periodontal probe designed to the TRS-621 specification was not available at the time and new colour coded periodontal probes (American Dental C.V.4) were used for the main survey, abandoning the 3.5 and 5.5 mm graduation in favour of the clearly visible, colour coded 3 and 6 mm graduation.

The pocket index for the main survey was:

Score 0: clinical gingival sulcus of 3 mm or less,

" 1: pocket depth greater than 3 mm but less than 6 mm,

" 2: pockets of 6mm or deeper.

Detailed account of measurement method is presented in Appendix 4.

3.3.3 CALCULUS

Only the absence and presence of calculus was recorded (score 0 and 1 respectively) and no differentiation was made between supra- and sub-gingival calculus.

3.3.4 RECESSION

Although the TRS-621 recommended the measurement of gingival recession, such measurement was abandoned after the pilot study as it was considered an inconsistent measure of periodontal disease manifestation.

3.3.5 TREATMENT NEED

The assessment of treatment needs demands that the prognosis of the disease be computed from the factors of age, duration of disease process and host resistance or disease severity as well as the anticipated lifespan of the subject. Although an index of treatment need had been formulated, it was recognized that a reasonable leeway of examiners' judgement would operate. The treatment need was assessed for each quadrant and assigned one of the following scores:

Score 1 : No positive score in the quadrant - no treatment required.

Score 2 : One or more positive bleeding score, indicating the need for oral hygiene education.

Score 3 : Calculus on pocket score of 1 for one on more teeth in the quadrant, indicating the need for scaling and oral hygiene education.

Score 4 : A pocket score of 2 for one or more teeth in the quadrant indicating a more intensive periodontal treatment need and oral hygiene education.

Score 5 : Generalized advanced periodontal destruction with severe loss of function indicating extraction of remaining teeth.

Calculation of treatment time requirements was done using estimates suggested by the W.H.O. (52) and the Periodontal Treatment Need System or P.T.N.S. (79).

3.4 PARTIAL RECORDING ASSESSMENT

****

Full recording data from the main survey were compared with several partial recording data derived from it, in the following manner:

Method I : Full recording : All 4 surfaces of all teeth present (third molars excluded).

" II : All 4 surfaces of the six index teeth.

" III : 3 surfaces of the six index teeth (buccomesial, buccal and buccodistal surfaces of maxillary teeth and linguomesial, lingual and linguodistal surfaces in mandibular teeth.

" IV : 2 surfaces of the six index teeth according to the original TRS 621 recommendation (buccomesial and buccal surfaces of maxillary teeth and linguomesial and lingual surfaces of mandibular teeth).

The six index teeth were : 16,21,24,36,41,44 (FDI notation), with distal neighbouring teeth as substitute should any of the index teeth be missing, but if both were missing no score was recorded and the mean scores adjusted accordingly. The data were evaluated using the following parameters:

1. Prevalence scores : the percentage of individuals with a positive scores on one or more of the surfaces included in groups I - IV.

2. Mean scores based on ratio of surfaces with a positive score and surfaces examined in groups I - IV.

3. Correlation coefficients based on prevalence scores and mean scores.

Periodontal parameters:

B = bleeding on probing.

C = calculus detected visually or by probing, no distinction was made between supra and sub gingival calculus.

P1 = periodontal pockets deeper than 3 mm but less than 6 mm.

P2 = periodontal pockets of 6 mm or more.

As calculus and bleeding scores were recorded by tooth rather than by tooth-surfaces, only Method I and II were applicable for calculus and bleeding scores, except in the calibration data where Method I was compared to Method IV.

Results from the calibration session were analysed to assess the inter-examiners' variability and the times taken to do the recordings.

3.5 EXAMINERS' CALIBRATION

****

Several intra- and inter-examiners' calibrations were held using the facilities of the Dental departments of the Royal Adelaide and Queen Elizabeth hospitals. The 2 examiners, the candidate (W. Srikandi) and the supervisor (N.G. Clarke), were both familiar with the examination method used in the survey and had used essentially the same method in their daily clinical duties. This might account for the ease with which intra-examiners consistency was achieved.

Intra-examiner calibration was carried out using patients being screened for allocation to dental students. 20 such patients were randomly selected by the receptionist for duplicate examinations, which were done at their first appointment with the student, i.e. prior to any treatment. Intra-examiner consistency was high for both examiners, with better than 80% consistency ratio in all categories.

Several inter-examiners' calibration sessions were held before satisfactory reproducibility was achieved. Result of the last calibration session is presented in Table III.5. Examiners' level of agreement in prevalence scores was calculated using a consistency ratio formula, whereby the number of occasions that a positive score was recorded by both examiners was divided by the total number of occasions that a positive score was recorded by at least one examiner,

in percent. All assessments were within the acceptable limit of at least 80% agreement. Bleeding and calculus scores in particular were highly reproducible, while periodontal pocket detection presented some problem as reflected by the lower level of consistency ratio. Student's t-distribution revealed no significant differences between prevalence scores, nor between mean scores, obtained by the two examiners (Table III.5).

During the pilot study, duplicate examination was done for 20 patients. A repeat calibration session was done just prior to the main survey.

Table III.5 Results of inter-examiners' calibration

	% PREVALENCE SCORES			
	Examiner 1	Examiner 2	t value#s	C.R
Bleeding	100	100	-	100
Calculus	100	100	-	100
Pocket 1	50	41.6	0.575	83.2
Pocket 2	45.8	54.2	-0.571	84.5

	MEAN SCORES		
	Examiner 1	Examiner 2	t value#
Bleeding	0.94 (0.03)	0.95 (0.02)	-0.250
Calculus	0.94 (0.03)	0.95 (0.02)	0.250
Pocket	0.59 (0.08)	0.63 (0.08)	-0.364

C.R. = consistency ratio.

( ) = standard error of the mean

n = 23

#t - distribution testing the hypotheses that the prevalence scores as well as mean scores obtained by examiner 1 and examiner 2 were equal, yielded the above t-values. The hypotheses were accepted.

3.6 SURVEY ORGANIZATION AND PROCEDURE

****

3.6.1 THE PILOT SURVEY

The Medical and Nursing staff in charge of the Ophthalmic clinic were consulted. A protocol of the study was submitted to the Royal Adelaide Hospital Research Review Committee and permission to conduct the survey obtained. Arrangements for the survey were done with the clinic staff's co-operation.

The survey was conducted in two rooms and a waiting area adjoining the Ophthalmic clinic. The Sister-in-charge directed all consenting patients between the age of 25-44 years to the waiting area, where they were asked to answer the self-administered questionnaire, to be returned to the examiner's desk on completion. The examiner called the next person to be examined and checked the questionnaire before commencing the oral examination. A cassette tape recorder was used to record the examination data, which were later transferred into the score sheet. The examination was carried out with the subject sitting upright in a swivel office chair with the head tilted back.

There were sufficient instruments (mouth mirrors and periodontal probes) to last each session, obviating the need for sterilization during the session.

3.6.2 THE MAIN SURVEY

Description and protocol of the intended survey was submitted to the management of the General Motor Holden Co.

Ltd., seeking its approval and support to carry out the study involving the company's employees. The company agreed to participate and meetings were held with the Company's Personnel Officers and Medical Superintendent to discuss further details. The following decisions were agreed upon:

1. Employee's participation would be entirely voluntary.
2. Initial invitation to participate in the survey would be issued through the Company's Personnel Department and other such communications should be done in liaison with the Personnel Officer assigned to the project. He would also issue appointment times, in co-ordination with plant supervisors.
3. The survey would be carried out during the company's working hours, including some evening shifts, but participation time would be limited to approximately 15 minutes per person.
4. As there was no suitable site within the Company's plant where a dental examination area could be comfortably set up, the survey would be conducted from two mobile dental caravans.
5. The dental caravans were to be parked at predetermined strategic sites within the Company's plant and supplies such as electricity and water would be provided by the Company.
6. Consent forms were to be signed by all participants.

So that disruption to the Company's productivity would be minimal, most of the survey was carried out at the Company's Woodville plant. However, as the number of female

employees at the Woodville plant was very small, the management agreed to extend the invitation for survey participation to female employees at the Elizabeth plant.

The survey was conducted at the Woodville plant during May vacation and at the Elizabeth plant in late November 1980. The Director of Dental Health Services, South Australian Health Commission, kindly agreed to lend two mobile dental caravans for the survey in May and one caravan for the November survey.

By kind permission from the Administrator of the Dental Department of the Royal Adelaide Hospital, survey assistants were recruited from the dental nurses at the Dental Department, four dental nurses joined the survey team in May and three in November. The nurses were briefed and familiarized with the survey procedure.

Instruments obtained for the oral examination were mouth mirrors, American Dental C.V.4 periodontal probes, some tweezers and instrument trays. As the caravan was equipped with high pressure 'Athena' sterilizer, several sessions of sterilization could be done throughout each day therefore obviating the need for a large number of instruments.

Survey forms and stationery supplies were obtained, and a brief referral form was also used to convey concise statements of the periodontal status to the participants' own

dentist for further assessment and management (Appendix 3).

The South Australian branch of the Australian Dental Association was informed of the planned survey and the referral procedures.

Several hundred toothbrushes, dental floss, toothpaste and dental health pamphlets were donated by courtesy of two dental supply companies, to be given to survey participants as free gifts.

Appointments were assigned to all participants. The survey was conducted in 2 sections:

(a) Self-administered questionnaire.

(b) Oral examination.

Participants were asked to answer the self-administered questionnaire at the desk in the caravan or weather permitting, using chair and table set up outside the caravan. He/she was then ushered into the examination area. The oral examination was carried out with the subject reclining on a Yoshida hydraulic dental chair illuminated with Ferro sunlight dental lamp, the examiner in the 11 o'clock position and the trained recorder seated opposite.

Upon completion, the subject was given the free gift and a sealed referral form as necessary.

3.7 TREATMENT OF THE DATA

****

With the assistance from the statistician (Mr. P. Leppard, Statistics Department, University of Adelaide), the questionnaire and examination format was assembled and coded for ready processing. At the completion of the survey, the forms were thoroughly checked before being forwarded to the statistician for analysis.

A small number of participants declined to answer some questions, particularly with regard to socio-economic status. For all occasions these made up less than 1% of the considered subgroups and were regarded to be of little significance. Discrepancies of total percentages from 100% occur from time to time, usually due to rounding off during calculation and sometimes attributable to the non-answer component. Where appropriate, statistical significance was tested using either paired t-test, Chi-square or one way analysis of variance.

CHAPTER IV

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RESULTS

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4.1 Results of the pilot survey.

4.2 Results of the main survey : oral examination.

4.2.1 Pattern of missing teeth.

4.2.2 Periodontal status.

4.2.3 Periodontal treatment need.

4.3 Results of the main survey : the questionnaire.

4.3.1 Pattern of dental visits.

4.3.2 Oral hygiene habit.

4.3.3 Periodontal care, experience and perception.

4.4 Cross tabulation of questionnaire and examination data.

4.5 Results of partial recording assessment.

4.1 RESULTS OF THE PILOT SURVEY

****

Sixty dentate patients aged 25-44 years attending the Ophthalmic clinic participated in the pilot study. The clinic system of group appointments resulted in considerable waiting time, in which the survey was conducted. Females predominated in the study population and the majority were in the 25 - 29 years age group. Approximately 60% had not had further formal education beyond secondary school. The majority of males were "blue-collar" workers, whereas the major group among females was equally divided into "white-collar" and "blue-collar" workers. Only 5% had a total family income of the upper level category and about half of the population was in the lower income level.

Females attended the dentist more frequently than males; the majority of females (71.5%) had visited the dentist within the preceding 12 months and had checkups at least once a year.

The majority of men surveyed (80%) only went to see the dentist for specific reasons, and only 28% had visited the dentist within the preceding 12 months. Those who had not had a recent dental appointment stated the most common reason as "nothing wrong" or "too expensive". Seventy five percent stated that they had never been told by their dentist that they had gum disease. Of the 25% who were advised otherwise, half obtained treatment. Consistently, more males stated

that they did not think there was anything wrong with their teeth/gums. About 60% expressed the desire to seek dental treatment/advice at the time. The open question regarding the type of treatment/advice was left blank in the majority of cases.

About 83% of males and females exhibited periodontal pockets of 3.5 mm or more. Nine males (36%) had pockets deeper than 5.5 mm, seven of them from the 40 - 44 years age group. Disturbingly, the other 2 were in the 25 - 29 age group.

Only 11% of females showed pockets deeper than 5.5 mm, spread over the 30 - 44 years age range. Almost all persons had gingivitis, in fact only one person (female, 24 - 29 years age group) had clinically healthy gingiva, with no detectable calculus or recession and requiring no treatment. All other persons required at least oral hygiene instruction, many needed simple or complex periodontal treatment.

A few people showed gingival recession, the number was too small to test statistically but the general clinical impressions supported the contention that recession was a poor indicator of presence and severity of periodontal disease.

Minor alterations to the survey format were made at this stage. The remainder of this chapter deals with results from the main survey.

4.2 RESULTS OF THE MAIN SURVEY : ORAL EXAMINATION

****

4.2.1 PATTERN OF MISSING TEETH

Tooth loss pattern showed a trend of sex specific differences in that the percentage of edentulousness was higher for females (8.3%) than males (4.7%), as were the mean numbers of missing teeth in all age groups. (Table IV.1 & Fig. 1). The overall prevalence of edentulousness was 5.6%, approximately two thirds of these were in the 44-64 years age group. Generally, there were higher percentages of edentulous subjects among the lower socio-economic strata, but the numbers were too small for further analysis (Table IV.2.

The association between age and tooth loss pattern among the dentate subjects is illustrated in Fig. 1 and Table IV.1 where the mean number of missing teeth increase with advancing age. Frequency distribution of tooth loss by tooth type reveals that the first molars were the most frequently lost, followed by upper molars and premolars, while anterior teeth were the most likely to be retained (Fig. 2). Occupational and educational level did not appear to be associated with the pattern of tooth loss, but income levels showed a trend of more missing teeth with higher income (Table IV.1). Those who regularly visited their dentist had fewer missing teeth than subjects whose dental visits were problem oriented, and the mean number of missing teeth increased as the frequency of dental checkup decreased.

TABLE IV.I Mean number of missing teeth in dentate subjects

	N	Mean	S.E.
By age #			
17-24	116	1.01	0.15
25-29	90	2.32	0.29
30-34	76	4.08	0.59
35-39	58	4.97	0.56
40-44	119	6.00	0.52
45-64	183	6.64	0.43
By sex ##			
Male	488	3.91	0.22
Female	154	6.12	0.49
By Income level ##			
Upper	111	5.47	0.57
Middle	385	4.59	0.26
Lower	140	3.20	0.40
By Regularity of visit ##			
Regular	271	3.81	0.25
Irregular	366	4.91	0.30
By Frequency of visit ##			
Twice or more a year	138	3.67	0.28
About once a year	228	4.12	0.32
Other, incl. irregular	276	5.10	0.36

S.E. = standard error of the mean.
Statistical analysis:
Regression analysis of the number of missing teeth on age revealed significant regression at 5% level.
One way analysis of variance rejected the hypothesis that the mean values were equal:
by sex : $t_{640} = 4.115$; $P<0.005$
by income level : $F_{2,633} = 6.333$; $P<0.005$
by regular visit : $t_{2,635} = 2.813$; $P<0.005$
by frequency visit : $F_{2,639} = 4.333$; $P<0.05$

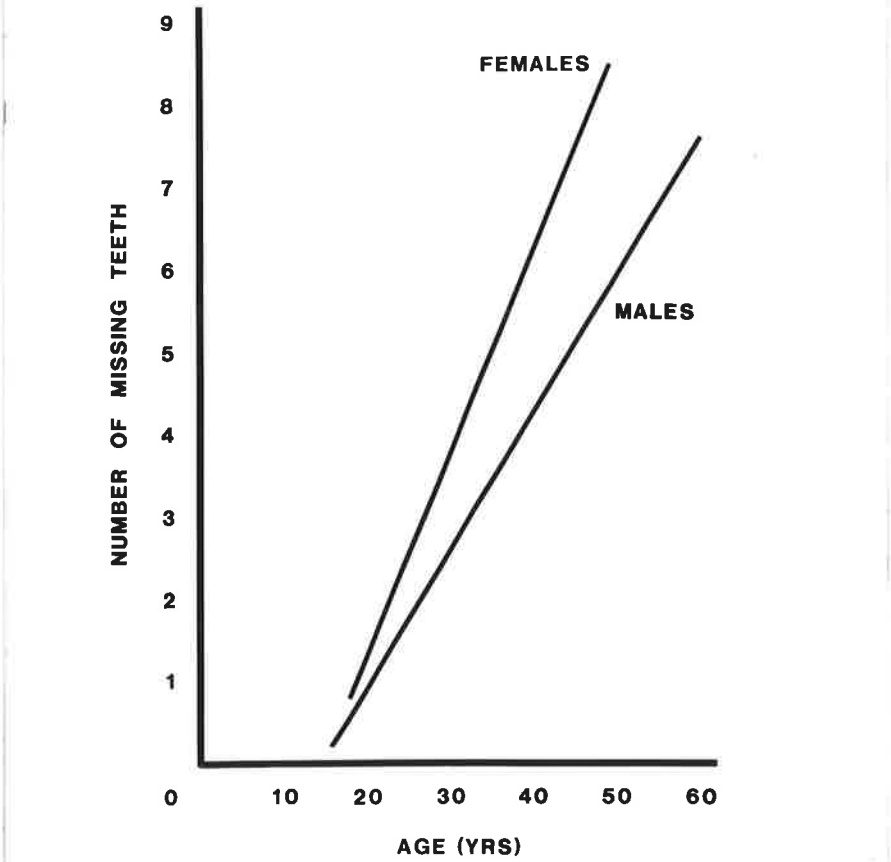

Fig.1. Regression analysis of the number of missing teeth on age for male and female participants.

Females : $m = -3.82 + 0.252a$;

Males : $m = -2.38 + 0.165a$;

where m = number of missing teeth and a = age.

Regression is significant at 5% level for both males and females. Regression lines are not equal for males and females at 5% level of significance.

TABLE IV.2 Percentage distribution of the 38 edentulous subjects by socio-economic status.

	Occupation	Education	Income
Upper	2.9	0.0	5.4
Middle	3.6	4.4	5.4
Lower	6.3	7.0	6.7

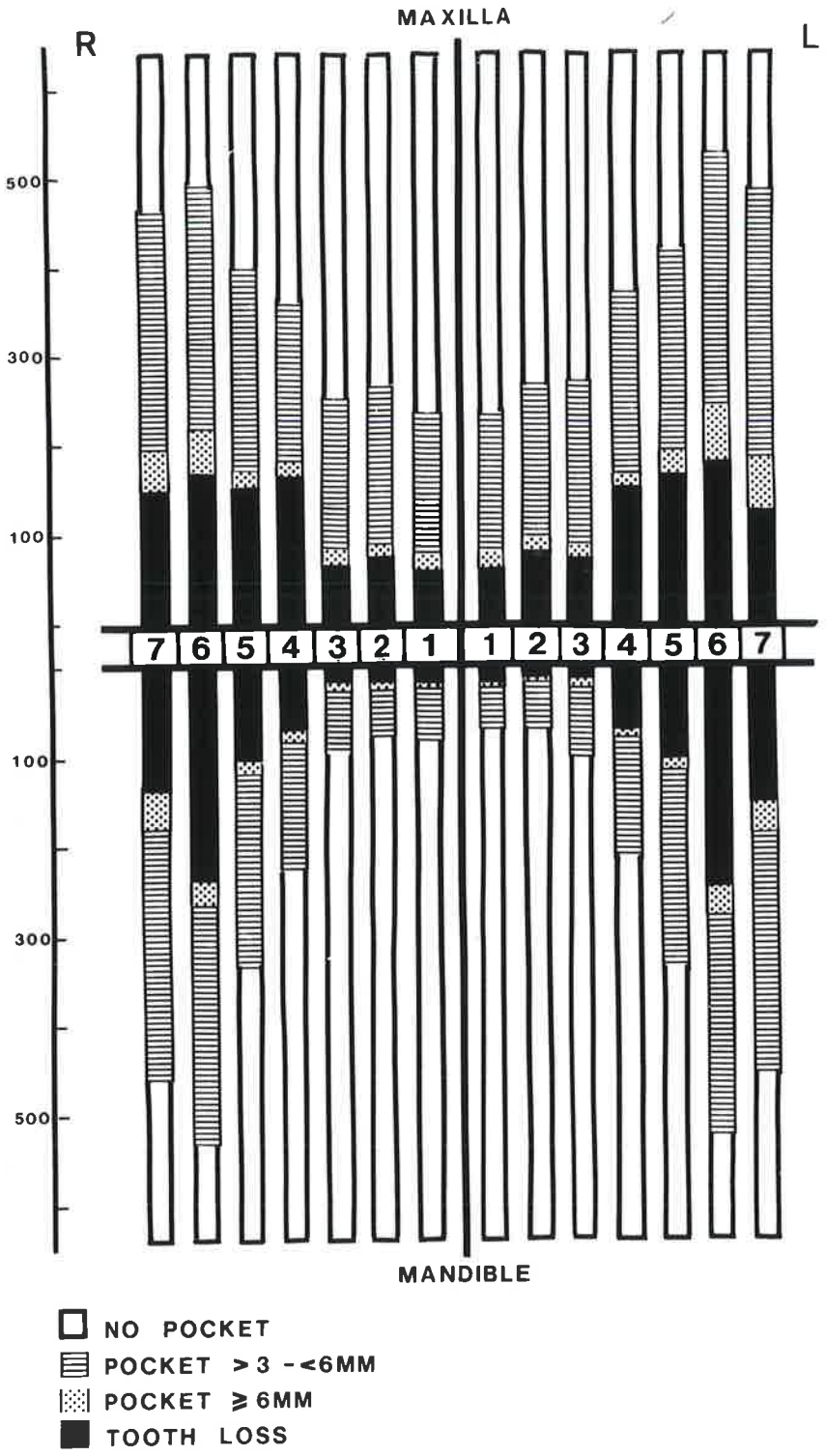

Fig. 2. Frequency distribution of missing teeth and periodontal pockets by tooth type. Tooth position is detailed on the horizontal bar with maxillary teeth above and mandibular teeth below.

N = 642.

(Legend) Table IV.3

The hypotheses that the different age groups had the same proportions of subjects scoring various categories of periodontal status were tested independently using chi-square distribution and 5 degrees of freedom:

- Gingivitis : Chi-square = 36.37; P<0.005
- Bleeding : Chi-square = 6.04; P: N.S.
- Shallow pocket : Chi-square = 20.15; P<0.005
- Deep pocket : Chi-square = 32.38; P<0.005
- Calculus : Chi-square = 37.93; P<0.005

The hypothesis was rejected for all but "bleeding" score. Age was significantly associated with gingivitis, pocket and calculus scores.

Table IV.3 Percentage distribution of subjects with positive scores in various categories of periodontal status (male and female dentate).

AGE (years)	N.	No Score	Gingivitis	Bleeding Crevice	Pockets >3 - <6mm	Pockets ⩾ 6 mm	Calculus
17-24	116	3.4	26.7	96.5	71.6	12.1	66.4
25-29	90	3.3	11.1	96.7	75.5	20.0	85.6
30-34	76	5.3	9.2	90.7	64.5	23.7	81.6
35-39	58	3.4	10.3	91.4	74.1	13.8	86.2
40-44	119	4.2	5.0	93.3	50.4	38.7	91.6
45-64	183	4.9	6.0	90.7	51.9	40.4	97.4
All ages	642	4.2	11.1	93.1	62.0	27.7	82.8

4.2.2 PERIODONTAL STATUS

Female participants consistently showed a trend of slightly lower prevalence as well as severity of periodontal disease compared to their male counterparts. As the female subgroups were very small in number, periodontal disease scores are presented as combined male and female data.

Age specific prevalence scores of bleeding index, gingivitis, periodontal pockets and calculus are presented in Table IV.3. Severity is expressed as the mean number of teeth with positive scores in the various periodontal disease measures (Table IV.4 & IV.5).

As the bleeding index score was not synonymous with "early gingivitis" but included any active pocket with an ulcerated, inflamed soft tissue wall, gingivitis scores was retrieved from "Treatment need" scores. Bleeding from gingival crevices/pockets after probing were seen in more than 90% of all participants in all age groups. Only 4.2% were free from any signs of periodontal disease. Early reversible gingivitis with no pocket formation was evident in 11.1% of subjects, decreasing from 26.7% in the youngest age group to 6% in the oldest age group. Shallow pockets were evident in 71.6% of the youngest group, rose slightly in the next age group, then gradually decreased with advancing years as subjects in the latter groups fell into the deep pocket category (Table IV.4). The percentage of subjects with one or more pockets of 6 mm or deeper increased with age. The

age specific differences in both shallow and deep pocket prevalences were statistically significant and calculus was present in most subjects with increasing prevalence in older age groups. The mean number of teeth with bleeding after probing gradually declined in the older age group while calculus was found on increasing numbers of teeth with advancing age. Deep pockets were recorded for an average of 2.29 teeth (standard error of the mean 0.87) among those under 25 years old, with an upward trend towards a mean of almost 4 teeth per person in the oldest age group, whereas shallower pockets affected approximately 6 to 9 teeth per person (Table IV.5).

Socio-economic distribution of periodontal pocket and calculus scores are presented in Table IV.6. Prevalence of shallow pocket decreased in lower occupational level accompanied by a rise in severe pocket prevalence. Educational and income levels showed no clear association with disease status.

Frequency distribution of pockets by tooth-type yielded a rather symmetrical histogram with the highest frequency of shallow pockets occurring in the upper molars, followed by lower molars, then upper premolars and lower premolars. Upper anterior teeth showed slightly lower frequencies than lower premolars, and lower incisors and canines were the least frequently affected (Fig. 2). The frequency distributions of deep pockets followed similar patterns but lagging someway behind.

Analysis of pocket distribution by tooth surface showed that approximal surfaces were the most frequently involved (Table IV.7). Distal pockets made up 46.3% of all pockets detected, mesial pockets 44.9% palatal/lingual and vestibular pockets 6.5% and 2.1% respectively.

Table IV.4 The mean number of teeth with bleeding on probing and calculus.

Age (years)	N	Bleeding			Calculus		
		n	Mean	S.E.	n	Mean	S.E.
17-24	116	112	16.75	0.64	74	9.81	0.73
25-29	90	87	16.98	0.57	77	11.52	0.83
30-34	76	69	14.84	0.85	62	12.57	0.96
35-39	58	53	13.20	0.99	50	13.96	1.03
40-44	119	111	12.70	0.62	109	13.83	0.68
45-64	183	166	12.28	0.56	160	15.18	0.82

Legend: One way analysis of variance revealed statistically significant difference in mean scores between age groups.

Bleeding : $F_{5,592} = 20.16$; $P<0.005$

Calculus : $F_{5,526} = 5.30$; $P<0.005$

Table IV.5 The mean number of teeth with pockets.

		Pocket >3 - <6 mm			Pocket ⩾ 6 mm		
Age (years)	N	n	Mean	S.E.	n	Mean	S.E.
17-24	116	83	9.42	0.72	14	2.29	0.87
25-29	90	68	9.53	0.68	18	2.50	0.56
30-34	76	49	9.10	0.91	18	2.72	0.84
35-39	58	43	8.16	0.83	8	3.25	1.24
40-44	119	60	5.76	0.47	46	2.94	0.34
45-64	183	95	6.21	0.49	74	3.51	0.41

Legend: One way analysis of variance yielded the following values:

Pocket >3-<6mm : $F_{5,392} = 6.61$; $P<0.005$

Pocket ⩾ 6mm : $F_{5,172} = 0.65$; P:Not significant.

Table IV.6 Prevalence of periodontal pockets and calculus by Socio-economic status (S.E.S.)

S.E.S.	N	P1 (%)	P2 (%)	C (%)
By occupation				
Upper	34	79.4	11.8	82.4
Middle	134	70.9	20.9	78.4
Lower	474	58.2	30.8	84.2
By education				
Upper	56	67.9	25.0	73.2
Middle	280	67.9	25.0	82.5
Lower	305	55.4	30.8	84.9
By income				
Upper	111	58.6	21.6	78.4
Middle	385	61.8	30.1	85.5
Lower	140	65.7	25.7	80.0

P1 = pockets deeper than 3 mm but less than 6 mm.

P2 = pockets 6 mm or deeper.

C = calculus.

Table IV.7 Distribution of periodontal pockets by tooth surface

Tooth Surfaces	Pocket >3-<6mm %	Pocket ⩾6mm (%)
Distal	43.2	3.1
Mesial	42.0	2.9
Palatal/Lingual	6.2	0.3
Vestibular	1.9	0.2

4.2.3 PERIODONTAL TREATMENT NEED

Periodontal treatment need scores (T.N.) were recorded by quadrants at the end of the oral examination. Because the purpose of obtaining this data was mainly to calculate manpower and cost requirement, combined male and female data is presented.

The criteria are as follows:

Score 0 = edentulous quadrant

Score 1 = no treatment needed

Score 2 = oral hygiene instruction only

Score 3 = simple periodontal treatment

Score 4 = complex periodontal treatment

Score 5 = extraction

Only 4.2% of participants did not require any treatment, 11.1% needed dental health education, motivation and oral hygiene instruction, which were also required for those in categories 3 (58.5%) and 4 (24.6%). In addition these latter groups would also require specific measures to treat the established disease. The periodontal disease in 8 persons (1.3%) were considered so advanced with extensive alveolar bone destruction and loss of function that extraction of the remaining teeth and denture construction were deemed to be the realistic treatment requirement (Table IV.8). Treatment needs of subjects in category 3 and 4 were further classified by quadrants to enable calculation of treatment time needed (Table IV.9).

The W.H.O. suggested an estimation of mean time required to provide periodontal services to be used in conjunction

with the TRS-621 method (Appendix 4). Such a formula would be dependent on many local factors, such as the availability of resources, the socio-cultural milieu and the prevailing philosophy of treatment. Assuming that the formula was locally applicable, it was administered to the present findings. By way of comparison, a similar calculation using the P.T.N.S time estimate (79) was also carried out. The W.H.O. time estimate used in the present calculation excluded the recommended follow-up time, which can be added on separately (Table IV.10). Both formulae take disease severity into account, additionally the W.H.O. estimate is age specific. The W.H.O. estimate yielded higher overall treatment time requirement, mainly due to its T.N.4 component, reflecting the different treatment philosophies underlying the two estimates (Table IV.11).

Table IV.8 Distribution of periodontal treatment needs (T.N.) in 3 age groups.

T.N. Score	17 - 29	30 - 44	45 +	TOTAL
	n (%)	n (%)	n (%)	n (%)
T.N.1	7 (3.4)	11 (4.3)	9 (4.9)	27 (4.2)
T.N.2	41 (19.9)	19 (7.5)	11 (6.0)	71 (11.1)
T.N.3	133 (64.6)	153 (60.5)	91 (49.7)	377 (58.5)
T.N.4	25 (12.1)	67 (26.5)	67 (36.6)	159 (24.8)
T.N.5	-	3 (1.2)	5 (2.7)	8 (1.3)

Table IV.9 The number of quadrants requiring T.N. 3 and 4.

T.N. SCORE	AGE GROUPS 17 - 29	30 - 44	45 +	TOTAL
T.N.3	460	600	385	1445
T.N.4	47	122	137	306

Table IV.10 W.H.O. and P.T.N.S. time estimate for provision of periodontal treatment.

T.N. SCORE	W.H.O. ESTIMATES 17 - 29 yrs	30 - 44 yrs	45 + yrs	P.T.N.S. ESTIMATES
T.N.2	60	10	10	60
T.N.3	65 + 15/Q	65 + 30/Q	65 + 30/Q	60 + 30/Q
T.N.4	80 + 115/Q	80 + 115/Q	80 + 115/Q	60 + 90/Q

Time estimate is given in minutes per person - and minutes per quadrant (Q). The W.H.O. estimate excluded the recommended "follow-up" treatment of 25 mins. + 5 mins./Q for T.N.3 and 10 mins. + 10 mins./Q for T.N.4 (Appendix 4). The P.T.N.S. criteria of class A, B and C are considered comparable to T.N. 2, 3 and 4 respectively.

Table IV.11 Periodontal treatment time requirements according to W.H.O. and P.T.N.S. estimates.

T.N. SCORE	W.H.O. ESTIMATE	P.T.N.S. ESTIMATE
T.N. 2	46 hrs.	71 hrs.
T.N. 3	1015 hrs. 55 mins.	1099 hrs. 30 mins.
T.N. 4	798 hrs. 30 mins.	465 hrs.
TOTAL ESTIMATE	1860 hrs. 25 mins.	1635 hrs. 30 mins.

4.3 RESULTS OF THE MAIN SURVEY : THE QUESTIONNAIRE

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4.3.1 PATTERN OF DENTAL VISITS

The time interval since the last dental visit was 12 months for 50.5% of the study population, between one to five years for 40.1% while 8.9% had not consulted a dentist for more than 5 years (Table IV.12). 4 males (0.6% of the sample) but no female participants claimed they had never visited a dentist. There was a trend toward more recent utilization of dental service by female participants.

Percentage distribution of participants whose last dental visit were within the previous twelve months by age, sex and socio-economic status revealed that female participants and those in the uppermost socio-economic levels tended to be more recent utilizers but none of the differences were statistically significant (Table IV.13). Approximately 42% of the study population declared that they usually had a regular checkup regardless of whether or not they were conscious of any problem. The remaining 57.5% stated that their dental visits were usually prompted by specific reason/problem. Percentage distribution of those who had regular checkups by age, sex and socio-economic status are presented in Table IV.13. Neither age nor sex appeared to be associated with regularity of visits. Socio-economic distribution however demonstrates a social gradient with an upward trend of regular service utilization among the higher socio-economic levels, although the

differences were only statistically significant among the occupation levels and barely so among the income levels ($P<0.05$). All regular attenders had visited the dentist within the previous 12 months.

The frequency of dental checkup in the past 5 years were twice or more a year for 21.5% of the study population and about once a year for 35.5%. As these add up to 57%, a higher figure than the 42.5% who stated they had regular checkups, it is assumed that some participants had misinterpreted dental "checkup" as dental "visit" and therefore the two data could not be related.

Table IV.14 lists the principal reason for non-utilization of dental services in the previous 12 months. The most frequently stated reason was that there was "nothing wrong" (57.5%) followed by "too busy or could not be bothered" (15.7%).

Table IV.12 Time interval since last dental visit, by sex

TIME INTERVAL	MALE (n = 488)%	FEMALE (n = 154)%	TOTAL %
0 - 12 months	49.0	55.2	50.5
13 - 18 months	16.0	20.1	17.0
1 1/2 - 5 years	25.0	16.9	23.1
More than 5 years	9.2	7.8	8.9
Never	0.8		0.6

Table IV.13 Pattern of dental visits (in percent).

	Last visit within 12 months N = 324	Regular visit N = 271
By Age		
17 - 24	48.3	41.7
25 - 29	53.3	43.8
30 - 34	48.7	37.3
35 - 39	48.3	41.4
40 - 44	57.1	50.0
45 - 64	47.5	40.1
All ages	50.5	42.5
By Sex		
Male	49.0	42.6
Female	55.2	42.5
By Occupation		
Upper	58.8	61.8
Middle	53.0	47.8
Lower	49.2	39.7
By Income		
Upper	55.9	53.2
Middle	51.7	41.0
Lower	42.1	37.7
By Education		
Upper	58.9	51.8
Middle	48.5	43.2
Lower	50.9	40.4

Fear or dislike of the dentist and cost each accounted for approximately 7% and 8% of the reasons offered. Non-utilization due to fear/dislike of dentist and cost appeared to be higher in the lower occupational and educational groups (Table IV.15), while the distributions of other reasons for non-utilization were similar in all other demographic subgroups. As the number of subjects in some subgroups were very small, no statistical significance test was employed.

Table IV.14 Main reasons for non-utilization of service in the last 12 months.

Main reason	%
Nothing wrong	57.5
Feared/disliked dentist	6.9
Too expensive	8.5
Too busy, apathy	15.7
Other reasons	5.7
No service available	1.3
No answer	4.4
N = 318	

Table IV.15 The percentage distribution of "fear" and "cost" as main reason for non-utilization, by occupation and education.

	FEAR (n = 22)		COST (n = 27)	
	Occupation	Education	Occupation	Education
Upper	0.0	0.0	7.4	11.1
Middle	18.2	23.8	25.9	37.0
Lower	81.8	76.2	66.7	51.9

4.3.2 ORAL HYGIENE HABIT

The majority of the study population (91.4%) claimed to brush their teeth at least once a day (Table IV.16). Although the number of subjects who brushed their teeth less frequently was small, it was decided to tabulate its frequency distribution by demographic variables (Table IV.17), whereby a trend was evident that the infrequent tooth brush user was typically male, under 25 years old and of lower socio-economic status.

Table IV.16

Percentage distribution of tooth brushing frequency.

	Male (n = 488)	Female (n = 154)	Total (n = 642)
Less than once a day	10.9	1.3	8.6
Once a day	47.3	35.1	44.4
More than once day	41.8	63.6	47.0

Table IV.17 Subjects who brushed less than once a day (N=55)

By age	%	By S.E.S.*	%
17 - 24	11.2	Upper	4.5
25 - 44	7.0	Middle	7.6
45 - 64	9.0	Lower	10.2

* combined S.E.S. indicator.

By contrast only 9.5% of the study population claimed to regularly clean the interproximal tooth surfaces. Percentage distribution by socio-economic status revealed that smaller proportion of this group came from the lower occupational and income levels, but the trend was reversed with education levels. In all cases the differences were small.

4.3.3 PERIODONTAL CARE, EXPERIENCE AND PERCEPTION

The majority of the study population (80.5%) had never been advised that they had periodontal disease ("gum problems") while 18.8% had been so informed at various times in the past and only 11.0% was aware that they had received periodontal treatment. When asked whether they thought at the time there was anything wrong with their teeth/gums/mouth, 42.8% believed there was nothing wrong, 11% thought "something was wrong with their gums" and 23.5% did not know. No significant association was found between disease perception and age nor sex. Socio-economic distribution does show a trend of lower awareness of periodontal disease presence among the lower strata, but the differences were not statistically significant. Approximately 64% of those surveyed expressed the intention to utilize dental service if it was readily available, however only a minority was able to specify the type of treatment they thought was needed, such as "scaling and polish" (4.2%) or restorations (5.5%) (Table IV.18).

Table IV.18 Types of treatment perceived to be needed.

TREATMENT	%
Don't know	20.6
Checkup	27.1
Restorations	5.5
Extractions	0.9
Full dentures	0.8
Scale and polish	4.2
Other	5.1
No need for treatment	35.8

(N = 642)

4.4 CROSS TABULATION OF QUESTIONNAIRE AND ORAL EXAMINATION DATA

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The association between periodontal status and demographic data has been discussed in section 4.2.

Bleeding on probing was a common finding, more than 90% of the study population in each sub-group had a positive bleeding index, any association with other variables would have been masked by the high prevalence. The time interval since the subjects' last dental visit did not appear to have any influence on their periodontal status other than calculus prevalence scores.

Neither regularity nor frequency of dental visits showed statistically significant association with pocket prevalence scores, apart from a slight trend of lower prevalence of severe pocket and calculus deposits among those who had regular and more frequent checkups (Table IV.19).

Subjects who brushed their teeth at least once a day had less advanced pockets and calculus deposit than those who brushed less frequently but the difference was not statistically significant. The minority who practised interproximal cleaning were often of European origin and in most cases it was related to the use of toothpicks for the purpose of dislodging food particles rather than a plaque control exercise. They surprisingly displayed higher

prevalence of advanced periodontal pocket and calculus deposits, although the differences were not statistically significant. Recognition of periodontal disease presence was generally very low and it followed no definite pattern of association with pocket or calculus prevalence. Whether periodontal disease had been diagnosed by the dentist or not did not seem to bear any relation to the prevalence or severity of periodontal disease.

Table IV.19 Percentage distribution of periodontal pockets and calculus.

	N	P1	P2	C
By regularity of visit				
Regular	271	66.1	22.9	74.9
Irregular	366	59.1	31.1	88.5
By frequency of visit				
Once or more a year	366	62.9	27.0	78.4
Other, incl. irreg.	265	57.7	31.8	88.7
Brushing frequency				
Less than once a day	55	58.2	34.5	87.3
Once a day	285	61.1	28.8	85.6
More than once a day	302	63.6	23.5	79.5
Interproximal cleaning				
Never	199	62.3	27.6	82.9
Sometimes	324	63.6	25.9	82.1
Less than once a day	58	56.9	34.5	81.0
Daily	61	57.4	31.1	88.5
Advised of disease presence				
Yes, < 1 year ago	49	55.1	36.7	83.7
Yes, < 5 years ago	42	42.9	50.0	83.3
Yes, > 5 years ago	30	60.0	33.3	93.3
Never	519	64.2	24.9	82.3
By own perception				
Something wrong with gums	70	52.9	37.1	87.1
Nothing wrong	417	61.6	28.5	81.5
Don't know	151	66.9	21.9	84.8

P1 = Pockets >3 - <6 mm ; P2 = Pockets ⩾ 6 mm ; C = Calculus

4.5 RESULTS OF THE PARTIAL RECORDING ASSESSMENT

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The percentage of individuals with positive findings based on the four methods are presented for two age groups (Table IV.20). The efficiency of the four methods in detecting surfaces with periodontal pockets decreased as less surfaces were included in the assessment, particularly with regard to pockets deeper than 6 mm.

The mean scores for tooth surfaces affected in percent of surfaces examined (i.e. surface ratio) are presented in Table IV.21.

Correlations between full and partial recording methods were lower when they were based on prevalence scores as compared to those based on surface ratio (Table IV.22 and IV.23). Method II and III displayed similar efficiency in detecting bleeding crevice, calculus and pockets, while method IV was the most inefficient when compared to full recording.

Inter-examiners' consistency ratio in all assessments were within the acceptable limit of "at least 80% agreement", as shown in Table IV.24. Bleeding and calculus scores'assessment in particular were highly reproducible, however periodontal pocket detection presented some problems, reflected by the lower levels of consistency ratio. Partial recording of deep pockets showed the lowest level of

inter-examiners' consistency. Statistically, there were no significant differences between scores obtained by the two examiners, in all categories of assessments.

The average time taken to do the examination was 54.8 seconds for partial recording and 3 minutes 43 seconds for full recording. The range was 30 secs.-1 min. 40 secs. for partial recording and 2 mins.-6 mins. 10 secs. for full recording.

Table IV.20 Prevalence of periodontal disease as assessed by Method I, II, III and IV (in percentage).

	<30 yr. olds	⩾30 years	All ages
	n = 206	n = 436	n = 642
Calculus			
I	73.3	87.4	82.9
II	67.0	83.7	78.3
Bleeding			
I	96.6	91.5	93.1
II	95.1	79.1	84.3
Pocket 1			
I	73.3	56.7	62.0
II	73.8	62.4	66.0
III	73.8	62.2	65.9
IV	64.1	57.1	59.3
Pocket 2			
I	15.5	33.5	27.7
II	6.3	17.9	14.2
III	6.3	17.2	13.7
IV	2.9	8.9	7.0

Method I Full mouth recording.
" II Partial recording of 4 surfaces of index teeth.
" III " " " 3 " " " "
" IV " " " 2 " " " "

Table IV.21 Mean scores of "surface ratio"# as assessed by the 4 methods

	<30 years n = 206	≥30 years n = 436	All ages n = 642
Bleeding			
I	61.2 (0.17)	51.6 (0.15)	54.7 (0.12)
II	50.2 (0.15)	39.1 (0.14)	42.7 (0.11)
Calculus			
I	29.9 (0.20)	55.9 (0.17)	47.6 (0.13)
II	29.3 (0.21)	55.6 (0.18)	47.2 (0.14)
Pocket I			
I	12.4 (0.07)	14.4 (0.06)	13.6 (0.05)
II	12.9 (0.08)	15.0 (0.06)	14.3 (0.05)
III	17.1 (0.10)	18.6 (0.08)	18.1 (0.06)
IV	11.6 (0.08)	14.3 (0.07)	13.4 (0.06)
Pocket 2			
I	0.4 (0.01)	1.5 (0.02)	1.2 (0.01)
II	0.4 (0.01)	1.6 (0.02)	1.2 (0.02)
III	0.5 (0.02)	2.0 (0.03)	1.5 (0.02)
IV	0.3 (0.01)	1.2 (0.02)	0.9 (0.02)

Tooth surfaces affected in percent of surfaces examined.

( ) = Standard error of the mean.

Table IV.22 Correlation coefficient (r) for partial recording scores with full mouth scores based on prevalence data

	Under 30 years			30 years and older		
	I	II	III	I	II	III
POCKETS (II	0.69			0.72		
POCKETS (III	0.69	1.00		0.71	0.98	
POCKETS (IV	0.50	0.73	0.73	0.60	0.75	0.77
BLEEDING II	0.83			0.59		
CALCULUS II	0.86			0.86		

I : Full mouth recording.

II : Partial recording of all 4 surfaces of index teeth.

III : " " of 3 " " " "

IV : " " of 2 " " " "

Table IV. 23 Correlation coefficient for partial and full mouth scores based on "surface-ratio" as assessed by the four methods

		<30 years				≥30 years		
POCKET 1:		I	II	III		I	II	III
	II	0.93			II	0.91		
	III	0.93	1.00		III	0.88	0.98	
	IV	0.86	0.93	0.93	IV	0.82	0.91	0.92
POCKET 2:		I	II	III		I	II	III
	II	0.85			II	0.88		
	III	0.85	1.00		III	0.88	0.98	
	IV	0.79	0.86	0.88	IV	0.74	0.85	0.86
BLEEDING:	II	0.82	-	-	II	0.83	-	-
CALCULUS:	II	0.96	-	-	II	0.97	-	-

Table IV.24 Inter-examiner consistency

	% PREVALENCE SCORES			
	Examiner 1	Examiner 2	t-value#	C.R.
FULL RECORDING (n=23)				
Bleeding	100	100	-	100
Calculus	100	100	-	100
Pocket 1	50	41.6	0.575	83.2
Pocket 2	45.8	54.2	-0.571	84.5
PART RECORDING (n=30)				
Bleeding	97	97	-	100
Calculus	97	93	0.714	95.9
Pocket 1	70	73.3	-0.229	95.5
Pocket 2	16.6	13.3	0.358	80.1

	MEAN SCORES		
	Examiner 1	Examiner 2	t-value#
FULL RECORDING (n=23)			
Bleeding	0.94 (0.03)	0.95 (0.02)	-0.250
Calculus	0.94 (0.03)	0.95 (0.02)	0.250
Pocket	0.59 (0.08)	0.63 (0.08)	-0.364
PART RECORDING (n=30)			
Bleeding	0.85 (0.03)	0.86 (0.03)	-0.275
Calculus	0.81 (0.04)	0.86 (0.05)	-0.817
Pocket	0.48 (0.06)	0.51 (0.06)	-0.412

C.R = consistency ratio.
( ) = standard error of the mean.
#t-distribution revealed no significant differences between scores obtained by examiner 1 and examiner 2.

CHAPTER V

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DISCUSSION

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5.1 The pilot survey.

5.2 Profile of the study population.

5.3 Dental service utilization pattern.

5.4 Oral hygiene habits.

5.5 Tooth loss pattern.

5.6 Periodontal status and treatment need.

5.7 Perception and experience of periodontal disease.

5.8 The W.H.O. 'TRS-62' periodontal survey methodology.

5.8.1 Assessment of gingivitis and periodontitis.

5.8.2 Plaque assessment.

5.8.3 Calculus detection.

5.8.4 Recession.

5.8.5 Periodontal treatment need.

5.9 Partial versus full recording method.

5.1 THE PILOT SURVEY

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The pilot survey served as a testing ground for the survey design and organization. Even with the small number of participants there was an apparent trend of sex differences in health oriented attitude and behaviour : 71.5% females, in contrast to 28% males, visited the dentist within the preceding 12 months. Only 32% male compared to 71% female participants had a regular checkup at least once a year. About the same percentages of both sexes stated that they would seek dental services if readily available, however when viewed together with other information, it would seem doubtful whether as many males as females would pursue this intention. Clinical data reflected similar trends, more males exhibited severe periodontal disease and heavier calculus deposit than females. Mild periodontal disease (bleeding on probing and shallow pockets) affected them equally and most of the pockets were found interproximally.

Periodontal disease prevalence and severity increased with age. All subjects except one young female participant required some periodontal treatment ranging from oral health education to complex treatment.

Due to the small number of subjects, the results could only be viewed as a trend. The discussion that follows pertains to results of the main survey.

5.2 PROFILE OF THE STUDY POPULATION

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Ideally it would have been very useful if a random sample of the whole population of Adelaide Metropolitan area could be studied. However the cost and other resource requirements of such an exercise was prohibitive, therefore the "convenient sample" was obtained.

Every attempt was made to define the study population with regards to variables relevant to periodontal disease, which can also be applied to the general population. If the convenient sample did not differ too greatly from the general population in terms of those variables, and because periodontal disease is usually highly prevalent, it can be argued that some degree of extrapolation should be possible with regards to the periodontal status of the two populations.

It would be of considerable benefit to make the study an ongoing project. As more resources and time become available, different population groups can be surveyed using the same parameters. Well defined, these surveys would yield valuable composite epidemiological data on periodontal disease in South Australia, including the trend of incidence with time.

Considerable efforts were made to reduce sources of population bias, and it is assumed that the process whereby

people participated in the present study is equivalent to a simple random sampling from the Company population.

In comparison to the Adelaide general community, the present study population had a much higher male component (M/F ratio of 3:1 instead of 1:1). The under 24 years group was slightly smaller, the 25-44 years group slightly higher and the 45-64 years group similar to that in the general population (2).

Using adjusted 1976 Census data as a basis for comparison, similar occupational grouping showed the present study population to comprise a much larger component of "blue collar" workers (74.4%) than the labour force in the community (44.4%). The upper occupation stratum was 5.1% in the study group, compared with 20.5% in the community (32).

In assessing education level, unlike the 1976 Census, the present study made no distinction between trade and technician certificates; both were included in the "middle level". Therefore the percentage of the middle occupation group might have been artificially inflated and can not be directly compared with corresponding figures in the community.

Of the group studied, 8.2% occupied the upper education level, 43.1% the middle and 48.2% the lower level. The middle educational level was comprised predominantly of workers who had not "matriculated" but who had undergone some

apprenticeship training of a technical nature. Such apprenticeship training is not generally expected to contribute to the socialization process in the same way that tertiary education does in so far as that socialization is associated with "better" health behaviour. The middle level therefore was not distinct from the lower level and it would appear that with respect to education the sample (apart from the upper 8.2%) was fairly homogenous in the context of dental behaviour.

A large percentage of participants belonged to the middle and upper income level. As the income indicator used in the present study was "family income" and all participants were income earners, the resulting data would have included any additional income besides those earned by the participants. In contrast, corresponding data obtained for the community includes income levels for pensioners, the unemployed as well as single and dual-income families, and therefore the "average income" can be expected to be lower. Moreover, the study population's higher income may imply an increase in purchasing ability without necessarily implying a concomitant upward mobility in social class strata.

Because figures obtained in the present study were derived differently from those available for the general communty, direct comparison can not be made with regard to educational and income status. Regarding occupational status it seems reasonable to consider the study group as predominantly "working" social class with a small component of middle class (40).

5.3 DENTAL SERVICE UTILIZATION PATTERN

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In the past decade South Australia has experienced widespread dissemination of information about oral health through education systems as well as various public information media. Increased awareness has led to better oral health behaviour generally, and this along with the effect of water fluoridation are probably responsible for the reduction in the incidence of dental disease, particularly dental caries in children (148). Meanwhile, the rate of growth in dental manpower, including operating auxiliaries, has increased much more rapidly than the general population. The overall result has been a present dentist to population ratio of 1:1750 in Adelaide Metropolitan area, which is well in excess of the recommended optimum ratio of 1:2240 (128). The dental manpower growth has been accompanied by a gradual increase in dental service utilization rate. South Australian figures obtained in National Health Surveys showed the percentage of adults who made dental visits in the 12 months previous to the surveys were approximately 39% in 1972, 41% in 1977, 45.5% in 1979 and 48.2% in 1980. (2, 11, 46, 159).

Of the present study participants, 50.5% claimed to have made a dental visit within the previous 12 months, a slightly higher figure than that obtained for the Adelaide population (48.2%) (2). This may have been partly due to the absence of

a component of unemployed in the study population compared to 9.1% in the community at the time. The exclusion of edentulous subjects may also have been a contributing factor. Nevertheless, the two utilization rates are similar and other surveys indicate this to be a common pattern. Barnard and Minns reported 50% utilization in the 12 months previous to a community household survey in Sydney metropolitan area (18). In Busselton, Western Australia, 57% claimed to have had dental care in the 12 months previous to a dental survey (106) and a similar figure was reported for the New Zealand population (44).

Whilst the last visit is a useful indicator of actual utilization of service, regularity of visits provides more information with regard to preventive dental behaviour. Regular checkup was reported by 42.5% of participants, compared to 44.8% for South Australians of similar age (161).

It appears that even though the study population was a "convenient" sample of the general population containing a higher component of "working" social class, the rate of recent utilization and the proportion of regular users of dental service were similar to those prevailing in the community at large.

The knowledge that only approximately half of the general population seek dental care regularly, despite the high dentist to population ratio in Adelaide metropolitan area, has been recognised for some time. Concern regarding

the other half who do not utilize dental services regularly has been frequently expressed in many quarters (10, 47, 65, 127, 164). It has been suggested that attempts be made to identify the non-utilizers' characteristics and the reasons for their reticence.

The decision to use dental services has been shown to be influenced by a multitude of complex and interacting factors (48, 83, 138) and social gradient has been demonstrated to be a strong correlate in the service utilization pattern, overriding knowledge, accessibility and the effect of removing the barrier of cost (129).

That persons higher in the socio-economic strata are more diligent in seeking dental care is well documented (129). Although income and education levels are known to have a strong positive relationship with utilization of dental service, there is evidence to show that they are but a partial explanation for the different pattern among segments of population (48). Occupation is usually a product of education and a determinant of income, therefore its association with utilization pattern commonly reflects the combined effects of income and education. In addition to the three indicators, socio-economic status involves beliefs, attitudes and behaviour that are inherent within each class level.

Blaikie (26), Hicks and Newcomb (70) reiterated the existence of discrepancies between the value systems of those

in the lower socio-economic strata and those higher in the social gradient which relate to many aspects of health behaviour. In almost every phase of health care and behaviour, the lower socio-economic group respond differently from those in the higher strata. The former tend to have higher prevalence rate for many diseases, have less accurate health information, define illness differently, are less inclined to take preventive measures and delay longer in seeking health care. They tend to feel intimidated by dentists and usually do not have a continuing personal relationship with them (26). Once under the care of a dentist, they are apt to get remedial rather than preventive care (28, 44). Attempts to understand health behaviour, including service-utilization, would need to consider these discrepancies.

While it is recognised that social class is not fully explained by occupation, education and income, the combination of these 3 indicators work to produce a reasonably strong factor in determining service utilization pattern. The 3 variables, as do some other socio-demographic factors, inter-relate to some degree and the significance of each is sometimes undermined. Accordingly, various workers have recommended the use of multiple classification analysis to evaluate their relative importance. In this way, Hëloe and Tronstad reported the following variables in descending order of influence: sex, region, age, education, school dental service, income and residence (69). Schwarz and Hansen reported a different result from their study: age,

occupation, residence, income, sex and school dental service, collectively explaining 41% of the variations in dental visit pattern (149).

The present study did not allow in depth assessment of all socio-demographic variables, nor was it considered appropriate to use the multiple classification analysis on the available data as the number of cells to be analysed would be inordinately high for some of the smaller subgroups.

Analysis of independant variables in the present study did show a trend of a social gradient with the regularity of visits, statistically significant for occupational and income levels, whereas age and sex did not show such an association, indicating that socio-economic status was possibly the more dominant factor (Table IV.11). The weak association with education level may have been due to the fact that the middle and lower educational levels were not sufficiently distinct, as discussed earlier.

Previous studies on dental attitude and behaviour in South Australia also noted the influence of social gradient on dental behaviour and status of school children and university students. (55, 57, 133).

The Australian Health Survey results showed a strong trend of decreasing rate of utilization with increasing age, although it is recognised that the number of teeth lost, which increased with age, may be a strong interacting

influence (2). Holst consistently found positive association between regular visits and edentulousness as well as number of missing teeth. This prompted him to advocate their use as strong predictors of dental utilization pattern (72, 149). It is noteworthy that one of the six age groups in the present study, 40-44 years, which contained almost half (40%) of the subjects of upper occupational level, showed the highest percentage of recent utilization and regular visits. All regular service users had visited the dentist within the previous 12 months.

A large percentage of subjects who had not used a dental service within 12 months previous to the present study, who were also irregular users, nominated "nothing wrong" as their principal reason (57.5%). This was perhaps an indication that they would only make a dental visit when prompted by a perceived problem, a commonly held attitude that has been reported in many studies (28, 76). On the other hand, "fear or dislike" (6.9%) are affective values, that in many societies tend to be suppressed or denied, sometimes unconsciously, therefore it is difficult to measure their true influence on dental behaviour. Cost as a barrier seemed to assume small significance, cited by only 8.5% as the main reason for non-utilization.

A Dental Health Survey in 1977 reported similar reasons for non-utilization of dental services for the Australian population, in that the majority nominated "nothing wrong" (76.8%), while "dislike/fear of dentist" and "cost" accounted

for 6.8% and 4.8% respectively (11). "Busyness/apathy" on the other hand figured more highly amongst the present group of employees (16.4%), compared with 5.4% amongst the Australian population.

Comparison with another Australian survey showed that the distribution of reasons for non-utilization were also rather similar (21) even though the latter involved younger and better educated subjects. In an earlier survey, approximately 30% of university students in South Australia nominated cost as the main reason for not obtaining regular care (57).

In the present study, fear and cost featured more prominently as occupational and educational levels decreased, none in the upper level conveyed "fear" as the main reason for non-utilization (Table IV.13). Income level on the other hand, did not show such a gradient. The significance of this anomaly is difficult to interpret, particularly as the number of subjects in the category discussed was very small.

It may be that compared to "income", education and occupation in the present sample exert stronger influence on attitude and belief which favour more preventive dental behaviour irrespective of cost. Generally, the influence of cost is difficult to assess accurately. Although findings have not been consistent, it is nonetheless hard to ignore the impression that income and cost of dental services are important market forces that influence patterns of service utilization.

The composite picture so far gained of the characteristics of irregular utilizers of dental services in the present study seems to be dominated by attitudes and beliefs on health behaviour, closely related to socio-economic status, with age and sex playing a lesser role.

5.4 ORAL HYGIENE HABITS

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A large majority of the study population brushed their teeth at least once a day (91.4%). Approximal cleaning was never or only occasionally practised by 81.5%. Even among those who claimed to practise it regularly, it was evident from casual conversation during the survey that their use was often associated with dislodgement of food particles after meals rather than intentional approximal cleaning. Dental floss was foreign to many, as judged by the number of questions about it. Those who practised oral hygiene irregularly were mostly males and tended to be of lower socio-economic status.

It is well accepted that periodontal disease can be successfully controlled by effective methods of plaque removal (89, 158). Until an effective alternative method free from side effects is found, the relatively crude mechanical plaque control has to be relied upon. The latter should include approximal cleaning. While most people are aware of the benefit of regular toothbrushing on oral health and its practice is commonly accepted, approximal cleaning enjoys less acknowledgement, perhaps because it is relatively tedious, time consuming and its adoption often entails a change of habit which requires strong positive persuasion and consistent reinforcement. Studies on oral hygiene habits in Australia indicate that few in the general community practise approximal cleaning (20, 115). Although the need for

interdental cleaning has been recognized for many years and aids to accomplish it are now widely available, its practice in the community is not generally widespread. There is no compelling reason to believe that the general population in Adelaide metropolitan area practise better oral hygiene than the study group.

5.5 TOOTH LOSS PATTERN.

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Previous studies noted that in developed countries females generally have better oral health than males and tend to suffer less periodontal disease (123, 140, 152, 165). Yet, their pattern of tooth loss is generally less favourable, suggesting that other reasons besides periodontal disease operate which culminate in tooth loss, such as caries, esthetic and prosthetic considerations. Pattern of missing teeth found in the present study was consistent with those reported for South Australians (46, 53, 135), in that the prevalence of edentulous persons as well as the mean number of missing teeth in dentates rose with age and were consistently higher in females compared to males of corresponding age groups. No attempt was made in this study to determine the cause of tooth loss.

The associations found between mean number of missing teeth and regularity as well as frequency of visits in the present study corroborate observations made in Norwegian and Danish populations (72, 149), in that utilization of dental services declined as the number of missing teeth increased. Furthermore, other studies have reported that lower social groups and irregular attenders tend to be treated by extraction rather than conservation (44, 61, 149). It is therefore contrary to expectation that the lower income group in the present study had fewer missing teeth than the middle

and upper income strata (Table IV.1), despite the fact that the latter groups had more regular visits (Table IV.13). It seems that the trends both in the number of missing teeth and its association with utilization of dental services are reversed in this income group. Possibly the different cultures, attitudes, and systems of service delivery in the various populations studied, as well as factors interrelated with income such as age or sex, could have been responsible for the unexpected finding. Although statistically significant, the difference in mean number of missing teeth between regular and casual attenders was only 1.1 teeth per person (Table IV.1). This is a very small difference, particularly when the cost of regular dental care is taken into account, raising some doubt on the long term benefit of regular care. Studies in England suggested that regular and irregular dental service users became edentulous at about the same age (71, 153).

Tooth loss pattern by tooth type may to some degree influence the observed periodontal disease pattern. Approximately one quarter of the dentition had been lost by the age of 45 (Table IV.1), following pattern shown in Fig. 2. Most of the deep pockets were found in molars, the observed lower prevalence of deep pockets in the lower first molar group was probably partly due to a higher extraction rate for these teeth. Clinical impressions support the belief that this disease pattern is commonly encountered and should be taken into account when using partial recording to obtain prevalence data for periodontal treatment need. Analysis

from the results indicate that the partial recording as suggested in the TRS-621 method may represent marked under-estimation of prevalence score, particularly of pockets, although mean scores generally correlate well with those of full recordings.

5.6 PERIODONTAL STATUS AND TREATMENT NEEDS

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Peridontal disease was found to be highly prevalent amongst the study population, affecting 95.5% of persons examined to various degrees. Both prevalence and severity was positively associated with age, confirming common findings elsewhere. The 35-44 years age group are especially useful in indicating the prognosis for periodontal disease in a community since they have an exposure time sufficient to allow the establishment of the disease (i.e. morbidity) but insufficient elapsed time to result in widespread tooth mortality. Epidemiological studies of periodontal disease showed a very high prevalence of advanced disease (over 75%) among persons 35-44 years in 7 countries, a high prevalence (45-75%) in 13 countries and moderate prevalence (less than 40%) in 15 countries (52). In the present study, 30.5 per cent of the 35-44 years age group had one or more pockets of 6 mm or deeper (i.e. advanced disease), placing the population in the "moderate prevalence" global data category. Inclusion of subjects with mild periodontal disease caused the percentage to rise to 88.7 per cent. Although the majority of periodontal disease observed was of mild to moderate severity, advanced periodontal disease was found in 25% of subjects. It is of concern that 12.1% of the group under 25 years of age had advanced periodontal disease, affecting an average of 2.29 teeth per person, indicating the group's very poor response to the etiological factors of

periodontal disease.

If these epidemiological data were to be useful in assessing the dental manpower requirements they should be translated into estimates of treatment needs and treatment time requirements. To exemplify such an approach, the W.H.O. and P.T.N.S. estimates were applied to the present findings (Table IV.10 and IV.11).

Assessment of periodontal treatment requirements demands that the prognosis of the disease be computed from the factors of age, duration of disease process and host resistance or disease severity as well as the anticipated lifespan of the subject. Whereas favourable host response and minimal disease levels in 45-65 year olds indicate that there is little risk of subsequent tooth loss in the anticipated lifespan, similar levels of disease severity in the youngest age group demonstrated levels of host susceptibility and disease presence that could well result in tooth loss in the future.

The 17-24 year olds among the 11.1% of subjects with gingivitis would appear to require efficient treatment whereas the 45-65 year olds with similar signs and symptoms could get by with little or no treatment. The W.H.O. estimate of time requirement for the provision of treatment incorporated a similar approach by assigning 60 minutes of Oral Health Education time (O.H.E) to the younger age groups and 10 minutes to the older groups (Appendix 5). Emphasis on

reinforcements of O.H.E. is also evident, adding to the length of time required in all age groups when compared to the P.T.N.S. evaluation. For category T.N.3, the W.H.O. estimated "scaling" time was longer for older age groups, whereas for the more severe T.N.4 category, treatment time requirements were equally extensive in all age groups. The T.N.4 category requires approximately a half hour longer per quadrant according to the W.H.O. estimate, when compared to P.T.N.S. calculation for similar disease level.

Mild to moderate periodontitis involved the highest percentage of subjects as well as the greatest number of teeth in each subject. This would seem to suggest that the greater part of treatment required was such that it could be managed by general practice dentists and their ancillary staff, as shown by the "treatment need assessment" result. The breakdown according to levels of treatment requirement, common to both W.H.O. and P.T.N.S. methods, provides flexibility for manpower and cost calculation. T.N.2 group, for example, can be managed by a dental hygienist or other auxiliary staff. Much of T.N.3 group's treatment can probably be provided by a team of dentists and hygienists rather than solely given by dentists.

Taking into account local availability of resources and associated factors, the manpower needed can be determined and its cost calculated.

Bellini and Gjermo had shown that the time difference

between calculations based on the total sample and one based on a subsample of 10% was only 4.5% (22). Increasing the subsample to 20% brought down the difference to 0.5%. They stressed that the subsample should be age representative.

In reality, the periodontal treatment time estimate will probably be applied as part of the total dental health care plan. In this way, individual case discussion and follow-up/maintenance care can be more appropriately incorporated in the total dental treatment time. Furthermore, the need for follow-up service may vary for different population subgroups and separate time calculation would give the planner flexibility in when and how to apply it.

Treatment need assessment would be further complemented if the incidence of the disease is also known. By constructing a prevalence/incidence ratio, the effects of the disease process and the effectiveness of care provided can be summed up (147). In this way, areas requiring priority of treatment or subgroups most in need of care can be identified. Despite efforts to carefully assess the manpower needs, it remains a limited measure, as the level of demand for dental service is ultimately the overriding factor. DeFriese and Konrad attempted to formulate a more comprehensive and rational estimate of manpower needs in the North Carolina dental manpower study (45), based on the following data:1) epidemiological measures of prevalence and incidence of the disease;

2) their translation into estimates of treatment need; 3) measures of the availability and productive capacity of the existing dental care system; 4) estimation of the potential effect of patterns of consumer demand for those services (demand was estimated at 25%, 50% and 100%). Such an approach to manpower planning for dental care delivery would be more relevant compared to that based solely on manpower to population ratio.

The findings that more than 90% of periodontal pockets occurred interproximally strengthens the conviction regarding the uncatered need for adequate approximal plaque control. No record was made of restorations present, nevertheless it was a common observation that many of the proximal inflammation was associated with poor restorations, particularly overhanging margins that acted as a predisposing factor for periodontal disease (86).

Many teeth have proximal concavities which are difficult to clean, as are the exposed furcations of upper premolars and molars. These factors contribute to the high prevalence of proximal pocket. While one has little control over anatomical features, there is considerable opportunity to improve the oral hygiene habit and restoration standard.

Frequency of toothbrushing is less significant than effectiveness in periodontal disease prevention. Scientific studies support the concept that plaque control once every 2 days if done effectively, could prevent periodontal disease.

Toothbrushing frequency probably implies an attitudinal component so that those who brush regularly and frequently probably tend to have other preventive dental health behaviour. These may account for the slightly better periodontal status among those who brushed their teeth more frequently.

5.7 PERCEPTION AND EXPERIENCE OF PERIODONTAL DISEASE

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Among the study participants there was a low awareness of periodontal disease presence in ALL subgroups, even though the oral examination revealed its very high presence. Only 11% recognised its presence at the time of the survey, furthermore those who perceived that they were free from it exhibited just as much periodontal disease. The low perception of periodontal disease signs has also been reported in other populations (27, 48, 111).

It is disconcerting to note that neither regular nor frequent dental visits showed significant reduction of periodontal disease prevalence compared with casual visitors, except for a weak trend of lower prevalence of advanced disease among those who had regular and more frequent checkups. The benefit of regular visits has been queried before (76, 153) and unless regular visits are associated with measures to prevent or treat periodontal disease, it is difficult to justify its "periodontal benefit". Among the subjects who were advised by their dentist that they suffered from periodontal disease, irrespective of the time interval since the diagnosis was made, slightly more than 90% had periodontal pockets, compared to 89% of those who were never advised of its presence, and the prevalence of calculus deposit was likewise very similar among those groups.

Half the study population claimed to attend a dentist

regularly and yet periodontal disease affected almost all of them, including those who had diagnosed periodontal disease. This finding implies that in the present group, periodontal disease had not been adequately treated.

Because the study population was a "convenient" sample caution needs to be exercised in any extrapolation of findings to the general population of the Adelaide Metropolitan area. Nevertheless, as the present sample showed a similar pattern of dental service utilization, and its oral hygiene habits probably were not unlike those of the general population, it would seem fair to suggest that the high prevalence of periodontal disease among the study population may not be atypical of the general community.

Surveys in Great Britain showed that irrespective of age, sex, social class, regular dental care of dentist/population ratio, periodontal disease had not been effectively treated (76, 152, 153); furthermore, the higher social class, which tended to be comprised of better utilizers of dental service, became edentulous at about the same age as persons from lower strata (71). Further analysis of treatments provided for patients in that study revealed that fillings, extractions and full or partial dentures predominated. As periodontal disease was found to be rife in the very same population, it would seem that a large number of the restorations were being placed on dentitions supported by a diseased periodontium. The high rate of extractions and edentulousness in the English study would seem to indicate

the futility of this approach.

Although regular dental care is viewed as an integral part of preventive behaviour, findings from the present study seriously question the benefit of the dental service provided therein on periodontal health.

The present study showed that periodontal disease apparently often went undiagnosed regardless of regular or frequent dental visits, or had not been effectively treated. Unless better diagnosis and more effective prevention or treatment of periodontal disease are employed, it would appear that improving dental service utilization could hardly be expected to rectify the high prevalence of periodontal disease.

There seems to be a pressing need to explore the reasons why periodontal disease are not being effectively prevented/treated by dental care providers and how the population can be made to be more aware and involved in maintaining their periodontal health.

5.8 THE W.H.O. 'T.R.S. 621' PERIODONTAL SURVEY METHODOLOGY

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The W.H.O. 1978 survey methodology was found to be simple and efficient. However there were some aspects that perhaps could be modified or defined more clearly for future users.

5.8.1 ASSESSMENT OF GINGIVITIS AND PERIODONTITIS

The subtle changes in gingival appearance of periodontal disease manifestations render its visual assessment subjective. Davies and Barmes (43) suggested that a bleeding index, such as Ainamo and Bay's Gingival Bleeding Index (G.B.I.) (4), would be simple and consistent. Furthermore, studies have shown that interproximal bleeding on probing occurred before inflammatory changes of the corium became visible clinically (107, 110). The gingival assessment method as proposed in W.H.O. TRS-621 however, differed from the G.B.I., which requires that three or four strokes be made with a blunt periodontal probe along the orifice of the gingival crevice. As such it is a simple, realistic measure of gingivitis, which has been shown to correlate highly significantly with Loë and Silnes Gingival Index (4). The proposed W.H.O. method suggested that: "the end of the periodontal probe is gently inserted between the tooth and the gingiva until the resistance of the supra-alveolar fibers is felt. When all six teeth have been probed for calculus and pockets, the same teeth are re-examined in the same sequence to ascertain whether the probing has resulted in

obvious bleeding from the gingival pocket or sulcus" (52). In this study, the same sequence was carried out for each quadrant. This method incorporates any bleeding elicited from the gingival crevice regardless of depth, which would occur when ever the integrity of the sulcular epithelium was breached by inflammatory changes. Gingival bleeding demonstrated by Ainamo and Bay's method undoubtedly reflects accurately the disease of gingivitis. The bleeding index demonstrated according to the TRS-621 method on the other hand represents the total potential of bleeding from a crevice, whether deepened or not. Since bleeding may occur from gingivitis or periodontitis, it is essential that an accurate diagnosis of the source of bleeding be established for accurate treatment and assessment. To measure gingivitis, a positive bleeding score should only be assigned when there is no periodontal pocket. The presence of both pocket and bleeding should be taken to indicate "active pocket" (119).

Despite the possible inaccuracies of probing (92, 162), when compared to visual assessment, it is relatively simple to perform a standardized method of probing. The detection of blood from a probed site is objective, recorded as either positive or negative.

It is equally important to record the severity of pocket formation using a periodontal probe as it is the only means of realistically assessing the severity of periodontal disease. Therefore both the bleeding index and periodontal

disease index are obtained by one method of periodontal probing that is quick, efficient and relatively objective.

Misgivings have been expressed with regard to probing in field surveys (43, 75), particularly concerning the difficulty in ensuring that the probe is used gently and sterilized adequately in difficult field conditions. If to avoid probing means that acquired data is highly suspect, then somehow sterilization has to be done. Similarly, rigorous examiners' training and calibration as a priority requirement would seem to be mandatory to ensure credible data.

Since this survey was completed, the new periodontal probe designed as specified in W.H.O. TRS-621 (Morita W.H.O. probe) has become available. The lightness of the probe and its rounded end make pocket and calculus detection easier, encourage gentler probing force and should help to make the task of future periodontal survey easier.

5.8.2 PLAQUE ASSESSMENT

The authors support the TRS-621 resolve not to assess plaque level as the assessment of gingival inflammation would have inherently included the consequences of the presence of plaque, as well as the effect of host resistance.

5.8.3 CALCULUS DETECTION

This study confirmed the well known association of prevalence and severity of calculus deposit with age.

Present periodontal treatment modalities still require that calculus be removed and root surfaces planed. TRS-621

method recommended therefore that calculus be assessed, not so much as a measure of disease but as a treatment need assessment. The method did not provide for any distinction between supra- and sub-gingival calculus. A descriptive population survey, particularly in developing countries, would probably gain little from any search for subgingival calculus. The mere presence of a pocket is sufficient indication for scaling and root planing. If enhanced degree of accuracy in predicting treatment time requirement is desired, particularly in restoration prone populations of some highly developed countries, it is suggested that a Retention index such as that proposed by Bjorby and Loe (94) be utilized.

5.8.4 RECESSION

Recession was not a consistent manifestation of chronic marginal lesion. Clinical impression showed that where present, it was just as likely to be a combined result of anatomical features and periodontal disease or toothbrush trauma, as a result of past periodontal disease or therapy. After the pilot survey, it was decided to exclude recession data from the oral examination.

5.8.5 PERIODONTAL TREATMENT NEED

When planning for treatment need, it would be prudent to also take into account the natural history of the disease and the prognosis of functional dentition within the person's life time. It would appear that the 6% gingivitis group in the 45-65 years group had indicated a very good host resistance as to require little treatment if at all. The 26.7% in the youngest group, in comparison, would dictate a weighted

priority. It is suggested that the assessment of actual treatment need be made for each quadrant at the time of examination.

The W.H.O. TRS-621 method was simple, efficient and appropriate for a descriptive population study. It is suggested that with a little modification of scoring for gingivitis assessment, the method provides meaningful basis for treatment need assessment of a population. Further, if for each age group the prevalence scores are combined, resulting in a "composite" periodontal community index, the total treatment needs of each group can be gleaned at a glance (38). e.g. the 30-34 years age group had an index of 9; 64; 23; which means 9% of this group had gingivitis, 64% had mild periodontitis and 23% had severe periodontitis. Such an index may be likened to the DMF index for caries.

5.9 PARTIAL VERSUS FULL RECORDING METHOD

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Figure 2 represents the frequency distribution of missing teeth and periodontal pockets by tooth type for all dentate persons. A marked degree of symmetrical distribution of corresponding scores is apparent for the right and left quadrants in both arches. The graph also provides for ready appraisal of cummulative morbidity scores as well as mortality scores of each tooth type. Percentage distribution of periodontal pockets by tooth-surface showed that 46.3% were found distally, 44.9% mesially, 6.5% occurred on palatal/lingual surfaces and 2.1% on vestibular aspects.

Prevalence scores showed calculus and bleeding on probing to be highly prevalent, shallow pockets were present in 62% and deep pockets in 27.7% of all subjects when full recording was employed.

Partial recording appears to be proportionately less efficient in detecting a positive score with decreasing prevalence as assessed by full recording. The more common the condition is, the more likely it is to involve the selected index teeth and therefore increasing the efficiency of the partial recording. Similarly, the type of teeth that are more commonly affected by periodontal disease, such as the molars, would increase the partial recording efficiency if included in the selected index teeth. Including both proximal surfaces of the index teeth yield prevalence scores

that are much higher than those of partial recording which employs one proximal surface only of each index teeth.

If the intention is to obtain an "average-severity" score, along the same line as Russell's Periodontal Index, the selected teeth should include one each of the molars, premolars and anterior teeth of both arches to represent the decreasing site-prevalence, while taking advantage of the symmetrical distribution in the right and left quadrants. In this way a 6-index teeth such as those recommended in Ramfjord's Periodontal Disease Index: 16,21,24,36,41,44, (FDI notation) or Loe and Silness selection for the Gingival Index: 16,12,24,36,32,44, would represent the severity of periodontal disease in the overall dentition.

On the other hand, if the concern is to identify as close as possible all individuals affected by the disease, i.e. prevalence score, the partial recording indicator should include the most commonly involved teeth and surfaces, i.e. the proximal surfaces of molar teeth.

The partial recording as originally recommended in the W.H.O. Technical Report Series 621 (method IV) was capable of detecting only 18.7% of advanced periodontitis in subjects under 30 years of age as assessed by full recording, and only 26.6% in subjects 30 years old and over. The age-specific differences in prevalence and severity scores suggest that the age of the study population must also be considered.

The apparently higher efficiency of partial recordings in detecting subjects with shallow pockets when compared to full recording methods is due to the fact that many of the non-index teeth recorded pockets of 6 mm or more, therefore shifting the individual into the deep pocket category; these non-index teeth were of course not assessed during partial recording. In the same way the reproducibility of the assessments of shallow pocket prevalence was higher when partial recording was used. The prevalence distribution of subjects with deep pockets was consistent with the above explanation, in that full recording yielded higher prevalence scores. In fact, the total number of persons having both categories of pockets was higher when assessed with full recording method. Partial recording yielded an overall underestimation of the disease prevalence, particularly with regard to the more severe signs of the disease. Inter-examiners' agreement was furthermore, lower with partial recording assessment of deep pockets, although it is not known what influence age difference might have as it was not considered during calibration session. TRS-621 partial recording method recommends that the upper teeth be examined from the buccal aspect and lower teeth from the lingual aspect. Anatomical consideration reveals that in the upper arch, contact areas between posterior teeth are situated further towards the buccal aspects, so that periodontal probing of the interproximal area from the buccal aspect would be restricted by the contact area to less than half way towards the palatal surface, unless very obtuse angle of the probe is employed. Furthermore, the mesial furcation of

upper molars are usually situated past the halfway mark towards the palatal aspect, probing from the buccal aspect may miss mesial furcal involvement in upper molars. As proximal surfaces are more likely to be periodontally involved than buccal surfaces, it is suggested that palatal approach probing of the upper posterior segment would be more effective than the recommended buccal approach.

In the lower arch, contact areas between posterior teeth are located approximately midway buccolingually, so that proximal probing from the buccal or lingual aspect are equally effective. The anterior segment often has thick calculus deposit on its lingual surface, causing proximal probing from this aspect difficult unless calculus is first removed.

The difference in terms of examination time was significant. However when the time taken for the whole procedure and organization of the survey is taken into account, which would be the same whether partial or full recording is employed, a difference of about 3 minutes per person assumes less magnitude. The more so when the overall cost of the survey is also considered. Subjectively, both examiners found partial recording much easier and required less effort.

Previous studies of partial and full recording methods have largely been confined to comparison of mean scores (7, 33, 49, 77, 78, 87). The findings generally show acceptable

positive correlation coefficients for mean scores obtained in both ways. While such scores are useful for comparative epidemiological data, treatment need assessment of the community would seem to be better appraised by prevalence scores. The higher correlation coefficient found when prevalence scores of the older group were considered, perhaps indicate that partial recording would be more suitably employed for surveying older populations, whereas for population younger than 30 years, full recording would be better able to detect subjects with signs of periodontitis. Such persons demonstrate magnified response to the etiological factors of periodontal disease and are in graver risk of tooth loss during their lifetime compared to similar disease severity groups of older ages. The former would need more vigorous periodontal care applied as early as possible and constitute an "at risk" group requiring early detection, therefore full recording should be employed.

CONCLUSION

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CONCLUSION

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Periodontal disease in the study population was highly prevalent and typically of moderate severity. Only 4.2% of the subjects were free from any signs of periodontal disease. In 11.1%, the disease manifestation was confined to reversible gingivitis. Mild periodontal disease was evident in approximately 60% and severe disease in 25% of the population. The major treatment requirement in all age groups could be categorized as "simple periodontal treatment" manageable by non specialist dental resources. More than 90% of pockets detected occurred interproximally. Periodontal disease prevalence and severity, as well as the number of missing teeth, increased with advancing age.

The proposed W.H.O. TRS-621 survey method was simple and efficient, but the partial recording approach yielded underestimation of disease prevalence, particularly with regard to severe periodontitis. It is suggested that full recording be used when assessing disease prevalence in younger age groups. The estimate of treatment time requirements as suggested in the W.H.O. report was found to be a useful model for manpower and cost evaluation.

Of the study population, 50.5% had their last dental visit within the previous twelve months and 42.5% had regular checkups. There was no significant association between time intervals since last dental visit and age, sex, occupation,

income or education; but regularity of checkup was weakly associated with occupation and income level, and subjects with fewer missing teeth went for more regular and frequent checkups. The most common reason for non-utilization was an assumption that "nothing was wrong". A large majority of subjects were unaware of the presence of periodontal disease or the need for its treatment, despite its high prevalence in all subgroups, as revealed by oral examination. The problems of analysing sociological aspects of dental behaviour were discussed.

The study population's pattern of service utilization was found to be similar to that reported for the general population, and their oral hygiene habits were expected to also be similar. This seems to imply that the high prevalence of periodontal disease found in the study population may also prevail in the general population. The present study further implies that as the periodontal status of regular users of dental service was not significantly better than non-users, increasing the utilization pattern would appear to offer little hope of improving periodontal status unless better methods of diagnosis, prevention and treatment are employed.

APPENDICES

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Appendix 1	Questionnaire form.
Appendix 2	Oral examination form.
" 3	Referral form.
" 4	Examiners' briefing.
" 5	W.H.O. periodontal treatment time estimate.

THE UNIVERSITY OF ADELAIDE

Department of Dental Health

Prevalence of Periodontal Disease in Metropolitan Area

REGISTRATION NUMBER C1 C3 [ ][ ][ ]

DATE C6 [ ][ ] [ ][ ] C11 [ ][ ]

NAME _____
Surname *Other Names*

ETHNIC GROUP C12

Asian	1
Australian	2
British	3
European	4
Others	5

1. SEX C13

Male	1
Female	2

2. AGE C14

25 - 29	1
30 - 34	2
35 - 39	3
40 - 44	4

3. USUAL OCCUPATION OF THE "BREADWINNER" C15

- Managerial level: *(general foreman to executive)* 1
- Factory supervisor and office worker. 2
- Factory worker: *(non-supervisory)* 3

4. EDUCATION *(your highest level of completed education)* C16

- Secondary school or below 1
- Trade, apprenticeship, others 2
- Tertiary education 3

5. TOTAL FAMILY INCOME

C17

- Less than - $10,000 ☐ 1
- $10,000 - $17,000 ☐ 2
- More than - $17,000 ☐ 3

6. DO YOU HAVE ANY OF YOUR OWN NATURAL TEETH?

- *If no, please disregard the rest of the questionnaire and return this form.*

C18

Yes ☐ 1
No ☐ 2

7. HOW LONG AGO DID YOU LAST SEE ANYONE ABOUT YOUR TEETH & GUMS?

C19

Within the last 12 months ☐ 1
12 - 18 months ago ☐ 2
18 months - 5 years ago ☐ 3
More than 5 years ago ☐ 4
Never ☐ 5

8. HOW WOULD YOU BEST DESCRIBE YOUR USUAL PATTERN OF DENTAL CARE?

C20

- Regular check-up from time to time, even though you're not conscious of a problem. ☐ 1
- Only for specific reason/problem. ☐ 2

9. HOW FREQUENTLY HAVE YOU GONE FOR DENTAL CHECK-UP IN THE PAST 5 YEARS?

C21

Twice or more a year ☐ 1
About once a year ☐ 2
Other ☐ 3

10. IF YOU HAVE NOT OBTAINED DENTAL CARE (including check-up) IN THE LAST 12 MONTHS, WHAT WAS THE MAIN REASON?

C22

- Nothing wrong ☐ 1
- Afraid of dentist, don't like dentist ☐ 2
- Too expensive ☐ 3
- Was too busy or couldn't be bothered ☐ 4
- No service available, difficult to obtain appointment ☐ 5
- Other ☐ 6

11. HOW OFTEN DO YOU CLEAN YOUR TEETH?

C23

- Less than once a day 1
- Once a day 2
- More than once a day 3

12. DO YOU USE ADDITIONAL MEANS TO CLEAN IN BETWEEN YOUR TEETH?
e.g. dental floss, tooth picks, etc.

C24

- Never 1
- Sometimes 2
- Regularly, less than once a day 3
- Regularly, at least once a day 4

13. HAS A DENTIST TOLD YOU THAT YOU HAD GUM PROBLEMS?

C25

- Yes, within the past year 1
- Yes, within the past 5 years 2
- Yes, more than 5 years ago 3
- Never 4

14. IF YES, DID YOU GET/OBTAIN TREATMENT?

C26

- Yes 1
- No 2

15. IS ANYTHING WRONG WITH YOUR TEETH, GUMS OR MOUTH NOW?

C27

- No 1
- Yes, teeth only 2
- Yes, gums only 3
- Yes, teeth and gums 4
- Yes, other 5
- Don't know 6

16. DO YOU WANT ANY DENTAL ADVICE OR TREATMENT?

C28

- Yes 1
- No 2

17. IF YOU DO, WHAT SORT OF ADVICE OR TREATMENT DO YOU WANT?

REGISTRATION NO. .....

EXAMINER .....

C4

P O C K E T S

Teeth	D	B	M	Li	Calc.	Bleed
17						
16						
15						
14						
13						
12						
11						

C5 1

T.N.	
	1. None
	2. O.H.I.
	3. Simple
	4. Complex
	5. Clearance

P O C K E T S

Teeth	M	B	D	Li	Calc.	Bleed
21						
22						
23						
24						
25						
26						
27						

C5 2

T.N.	
	1.
	2.
	3.
	4.
	5.

P O C K E T S

Teeth	D	Li	M	B	Calc.	Bleed
37						
36						
35						
34						
33						
32						
31						

C5 3

T.N.	
	1.
	2.
	3.
	4.
	5

P O C K E T S

Teeth	M	Li	D	B	Calc.	Bleed
41						
42						
43						
44						
45						
46						
47						

C5 4

T.N.	
	1.
	2.
	3.
	4.
	5.

APPENDIX 3. Referral form.

THE UNIVERSITY OF ADELAIDE
Department of Dental Health

Dear Doctor,

During a periodontal disease prevalence survey, conducted by the Department of Dental Health, University of Adelaide, this person was found to suffer from -

mild/moderate/severe periodontal disease

Would you care to see and treat him as you see fit?

N. G. CLARKE

Senior Lecturer in Periodontology.

W. SRIKANDI

Teaching Registrar,
Dept. of Dental Health.

APPENDIX 4
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EXAMINERS' BRIEFING
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PERIODONTAL PREVALENCE SURVEY - THE CLINICAL ASSESSMENT

Instruments :	Mouth mirror and periodontal probe
Teeth to be examined :	All fully erupted teeth excluding third molars. F.D.I. notation is used.
Sequence of examination :	Examination is to start from tooth 17 in the upper left quadrant, proceeding leftwards to quadrant 2, then to 37 of the third quadrant proceeding toward 47 in the lower right quadrant. 1. Pocket depth measurements are to be done first, at the same time feeling for any subgingival calculus, to reduce multiple probings. 2. Calculus scores are therefore recorded at the same time as pocket depth measurement of each tooth. 3. After pocket depth and calculus have been measured for the whole quadrant, bleeding score is recorded for that quadrant. 4. Treatment need for that quadrant is then scored, unless it was deemed necessary to score it later. All assessments are to be completed in each quadrant before proceeding to the next quadrant.
Pocket depth measurement :	A mouth mirror and a periodontal probe are used. The probe: American Dental Color Vision probe "CV4", with graduation at 3,6,9 and 12mm. Pockets are measured from 4 aspects : mesial, distal, facial and lingual. In the maxilla, assessments of the mesial and distal surfaces are made from the facial aspect. In the mandible the mesial and distal surfaces are measured from the lingual aspect.

Starting from the first quadrant, teeth 17 - 11 are measured from the facial aspect in the following order: distal, facial, mesial. The palatal aspects of 11 to 17 are then proved and scored. If any calculus is felt or seen during the probing, it is scored at that time. The second quadrant is examined from 21 to 27 from the facial aspect in this order: mesial, facial, distal. Then going back from 27 to 21, the palatal pockets are assessed. The third quadrant is examined from 37 to 31, from the lingual aspect in this order: distal, lingual, mesial. Then the facial aspects are assessed from 31 to 37. The fourth quadrant is examined from the lingual aspect in this order: mesial, lingual, distal surfaces of 41 to 47, then the facial aspects of 47 to 41. All pocket depths are to be measured from the crest of the gingival margin.

Criteria:

Score 0 - clinical gingival sulcus of 3mm or less.

Score 1 - pockets greater than 3mm and less than 6mm.

Score 2 - pockets equal to or greater than 6mm.

Calculus measurement : Only absence (score 0) or presence (score 1) of calculus is noted. No differentiation is made between supra- and sub-gingival calculus.

Gingivitis assessment: When all teeth in a quadrant have been probed for pocket and calculus assessments, the same teeth are examined for interproximal bleeding. Only absence (score 0) or presence (score 1) of bleeding is recorded, without severity grading. The bleeding interproximal unit is scored against the tooth distal to it. The interproximal areas between the central incisors are only scored once in each arch, i.e. against 11 and 31 only. No bleeding score is to be recorded against 21 and 41.

Periodontal treatment need assessment : Score 1 - No treatment required. All teeth in the quadrant are free from any positive score.

Score 2 - Oral health education. There is one or more positive bleeding score in the quadrant but

no calculus or pocket score.
Score 3 - Indicates the need for scaling and oral health education: there is one or more calculus score and/or shallow pocket (pocket score of 1) in the quadrant.
Score 4 - Indicates the need for complex care which may comprise deep scaling with/without any extraction and/or surgery, as well as O.H. education. There is one or more pocket score of 2 in the quadrant.
Score 5 - Generalized advanced periodontal destruction with severe loss of function, indicating extraction of all remaining teeth.

There may be individual cases in which the criteria are not fully satisfactory for defining the treatment need. Examiners should then exercise their clinical judgement in determining which type of treatment best fits the findings.

It should be remembered however, that the unit of study is the group of people, individual exceptional cases will be accommodated by the group score.

APPENDIX 5. W.H.O. Periodontal treatment time estimate.

Estimate of mean time required to provide periodontal services

Age-group (years)	Positive score for	Service	Time required
15–19	Gingivitis	Oral hygiene education (OHE)	60 min
	Calculus or shallow pockets	Scaling + OHE	
		initial	15 min + 10 min/quadrant + 50 min for OHE
		follow-up	15 min + 5 min/quadrant + 10 min for OHE
	Deep pockets	Deep scaling + OHE	
		initial	45 min/quadrant + 50 min for OHE
		follow-up	10 min/quadrant + 10 min for OHE
		Surgery	60 min/quadrant + 20 min postoperative care
20–29	Treatment as for age-group 15–19 except that the time required for initial scaling is 15 min/quadrant.		
30–44	Gingivitis	Oral hygiene education (OHE)	10 min
	Calculus or shallow pockets	Scaling + OHE	
		initial	15 min + 30 min/quadrant + 50 min for OHE
		follow-up	15 min + 5 min/quadrant + 10 min for OHE
	Deep pockets	Deep scaling + OHE	
		initial	45 min/quadrant + 50 min for OHE
		follow-up	10 min/quadrant + 10 min for OHE
		Surgery	60 min/quadrant + 30 min postoperative care
45 and over	Gingivitis	Oral hygiene education (OHE)	10 min
	Calculus or shallow pockets	Scaling + OHE	
		initial	15 min + 30 min/quadrant + 50 min for OHE
		follow-up	15 min + 5 min/quadrant + 10 min for OHE
	Deep pockets	Deep scaling + OHE	
		initial	45 min/quadrant + 50 min for OHE
		follow-up	10 min/quadrant + 10 min for OHE
		Surgery	60 min/quadrant + 30 min postoperative care

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