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# The Economic and Social Impact of Periodontal Disease

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THE ECONOMIC AND SOCIAL IMPACT of periodontal disease is a subject for which scientific information is scarce, nationally and internationally. Consequently, much of what we present here is general and deduced from a myriad of papers dealing with facts and theories that are only indirectly related to the subject. The dilemmas that confronted us in gathering information were further complicated by the diversity and complexity of the problems caused by differences in age, race, and customs, as well as the stages of economic development, nutrition, education, and availability of health care for various populations.

At the World Workshop on Periodontal Disease in 1966, the only direct consideration of its social and economic impact was four short paragraphs presented by Waerhaug (1), in which he discussed the epidemiology of periodontal disease in association with socioeconomic status. By contrast, the Second International Conference-Workshop on Research in the Biology of Periodontal Disease, held in Chicago, June 12-15, 1977 [after this paper was prepared] devoted one of the eight workshops entirely to the subject.

We raise a number of questions about data regarding the social and economic impact of periodontal disease that could and should be available, and we suggest ways by which such information can be acquired.

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A review of the literature that deals specifically with the social and economic impact of periodontal disease is difficult because, as mentioned, the literature generally has not evolved along these lines. Much of what can be considered related literature deals with demographic and epidemiologic studies. Although 3 computer searches of 1966-77 literature generated 74 pages of bibliographies containing more than 700 articles, only 30 of these articles were actually related to the subject of this paper (2-31). Of these 30 articles, most were only tangentially related and their differing approaches to data gathering and analyses make comparison and correlation of the results arduous and vulnerable to criticism.

Since the 1966 workshop on periodontal disease, there has been an awakening of sociological interest in dentistry. Several recently published books and compendiums should be required reading for those interested in applied and theoretical sociodental research (32-35). These source books provide extensive bibliographies. We discuss some of the articles in these books later in this paper. Another portion of this paper is devoted to two articles by Ingle (36,37), an intriguing article by Cohen and Jago (38) in which the concept of "sociodental indicators" is introduced, and a recent report of a World Health Organization expert committee (39).

## Extent and Consequences

The social and economic impact of periodontal disease in the United States can be seen in better perspective from reports of the relation of the disease to other oral diseases and tooth loss and the influence of such factors as general health, age, race, education, and family income (40-48).

Periodontal disease is not a disease of the elderly. It starts in childhood, and its prevalence and severity increase with age. Thus, the end stage of the disease is seen much more frequently in older people (37), as evidenced by the periodontal index (PI) shown in figure 1 and the following data. The average PI for children, youths, and adults (37, 44) was:

Age group and years	Mean PI
Children, 6-11 years, 1963-65	0.13
Youths, 12-17 years, 1966-1970	0.31
Adults, 18-79 years, 1960-63	1.13
18-24	0.54
25-34	0.75
35-44	1.04
45-54	1.42
55-64	1.84
65-74	2.05
75-79	2.92

The percentage distribution of children, youths, and adults, by status of periodontal disease (37,44-46) was:

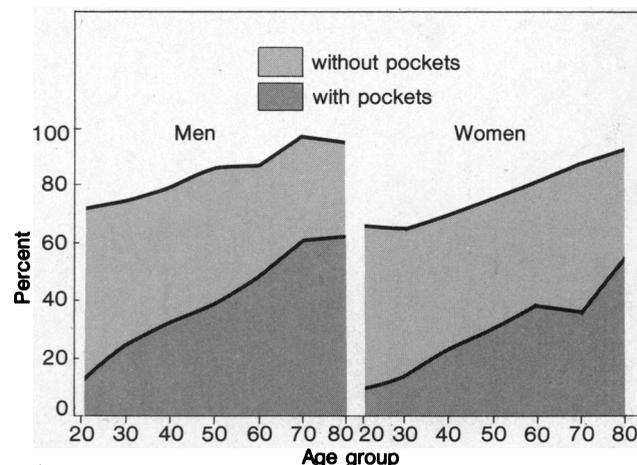
Age group, years, and status of periodontal disease	Percent distribution
Children, 6-11 years, 1963-65:	
Without periodontal disease	61.3
With periodontal disease	38.7
Without pockets	37.9
With pockets	0.8
Youths, 12-17 years, 1966-70:	
Without periodontal disease	32.1
With periodontal disease	67.9
Without pockets	62.1
With pockets	5.8
Adults, 18-79 years, 1960-63:	
Without periodontal disease	26.1
With periodontal disease	73.9
Without pockets	48.5
With pockets	25.4

Among adults, men have a greater incidence and severity of periodontal disease than women (fig. 1). The percentage distribution of adults in 1960-62 (37,48), by status of the disease, race, and sex was:

Race and sex	Without periodontal disease	With periodontal disease	
		Without pockets	With pockets
White, both sexes	27.8	48.3	23.9
Men	22.4	48.7	28.9
Women	33.0	47.8	19.2
Negro, both sexes	15.8	48.2	36.0
Men	12.2	48.9	38.9
Women	19.1	47.6	33.3

Reports of several studies indicate that women are

Figure 1. Percentage of men and women with periodontal disease, with and without pockets, by age groups (years), United States, 1960-62



SOURCES: References 37 and 48.

less prone to the disease than men (1,4,10). Russell (49) and Mehta and associates (50) reported that different races with equivalent socioeconomic status have a similar incidence of the disease.

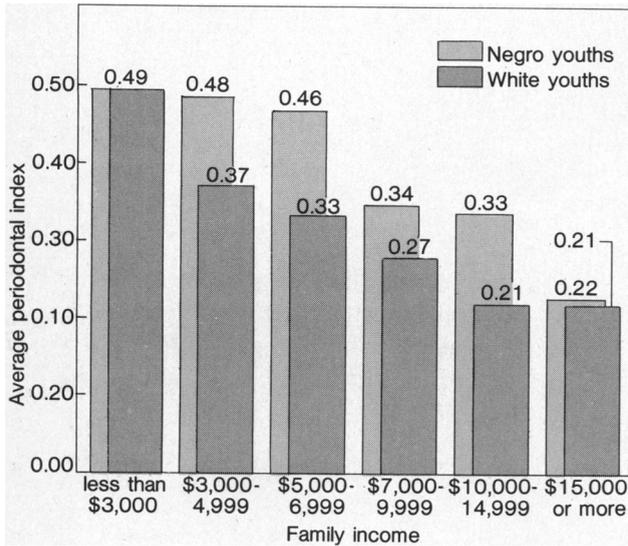
For children, the average PI decreases as family

income rises. However, Negro youths have higher PIs than white youths at every income level, except when it is less than \$3,000. White and Negro youths from families with incomes less than \$3,000 have the highest PIs (fig. 2). Education of the head of the household seems to be related to the PI in youths 12-17 years old. The PI was more than 4 times as high in youths from households where the heads had less than 5 years of formal education as in youths from households whose heads had 17 or more years of schooling (fig. 3).

Periodontal disease is the leading cause of total and partial tooth loss (37,40,47,48). The social and economic impact can be gleaned by deduction and inference from a number of known quantities. The extent of edentulousness (fig. 4), the wearing of dentures, satisfaction with dentures worn, cost of dentures and other prosthetic appliances, and the cost and emotional and physical strain connected with dental care provide indices that reflect the social and economic impact of the disease. Another index is the number of people who seek cosmetic improvement by the replacement of lost teeth splayed by periodontal disease. Also, the nearly \$1 billion spent annually on all oral hygiene products reflects significant economic impact ("Drug Topics," October 1974).

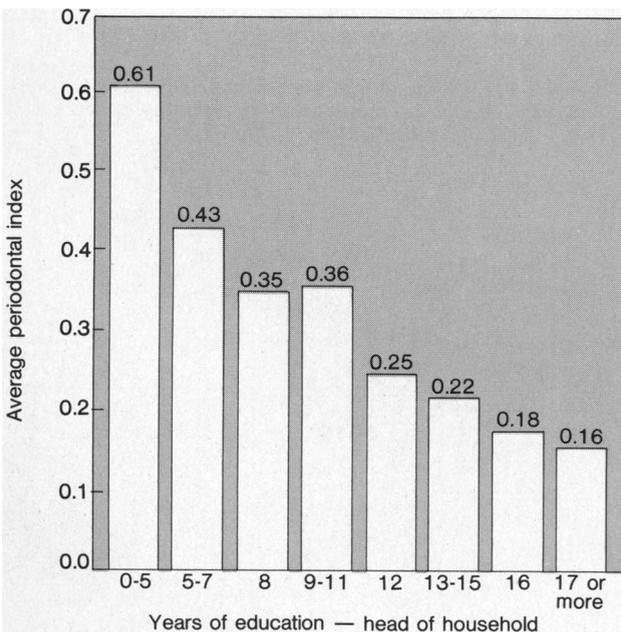
More people go to dentists for fillings than for any other operative service. The following are estimates

Figure 2. Average periodontal index for Negro and white youths aged 12-17 years, by family income, United States, 1966-70



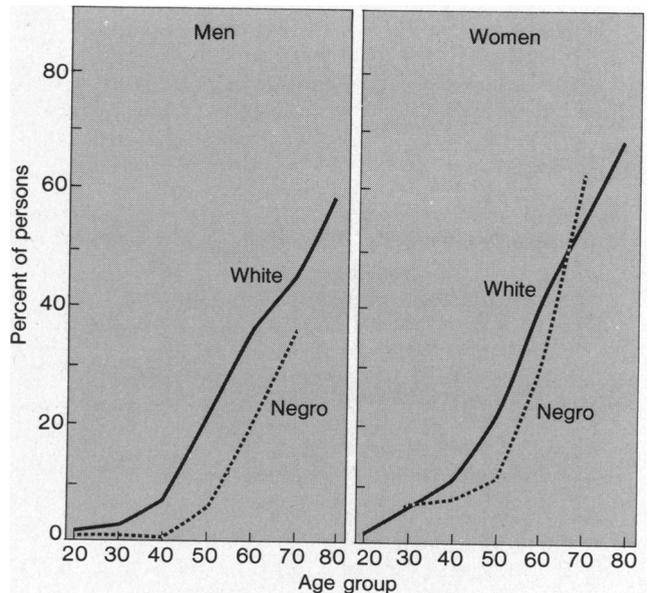
SOURCES: References 37, 42, and 45.

Figure 3. Average periodontal index for all youths aged 12-17 years, by education of head of household, United States, 1966-70



SOURCES: References 37 and 45.

Figure 4. Prevalence rates of edentulous men and women, by race and age group (years), United States



SOURCES: References 37, 40, and 47.

of the costs of fillings and other services in 1969 (37):

Oral examinations .....	\$ 83,500,000
Prophylaxes .....	76,600,000
Radiographs .....	268,400,000
Amalgam fillings .....	159,200,000
Gold inlays .....	5,400,000
Acrylic fillings .....	15,100,000
Silicate cement fillings .....	23,800,000
Other fillings .....	10,000,000
Teeth removed .....	56,000,000
Single crowns placed .....	11,400,000
Fixed bridges placed .....	4,000,000
Complete upper dentures .....	3,600,000
Complete lower dentures .....	2,300,000
Partial dentures .....	4,200,000
Orthodontic treatments .....	20,000,000
Periodontal treatments .....	8,300,000
Root canal treatments .....	9,200,000
Fluoride treatments .....	12,200,000

In the 1971 U.S. Health Interview Survey, it was estimated that 22.6 million people were totally edentulous. Most of the tooth loss was due to periodontal disease, and at least 75 percent of the people had some form of the disease. Of the remaining 25 percent, about half had 18 or more decayed, missing, or filled teeth (40,47,48). About three out of four people with natural teeth had periodontal disease, and about one out of four had advanced periodontal disease with pocket formation (40,46).

Although our ultimate goal is eradication of dental disease, a more immediate goal is to reduce tooth loss. According to the 1971 U.S. survey, the percentage of edentulous persons discloses the prevalence of dental disease and the success or failure in the delivery of dental services (40). It is interesting and encouraging that the percentage of edentulous persons in the 1971 survey was 1.8 percent less (11.2 percent) than in the 1957-58 survey (13 percent); these percentages convert to more than 3.6 million fewer edentulous persons in 1971 than in 1957-58. These figures take on even greater significance when we consider the increased lifespan in 1971, which afforded more time for tooth loss.

Edentulousness increased with age, lower family income, and less formal education (37,40). It was slightly less frequent in males than in females, significantly less in black males than in white males, and significantly—but less marked—less in black females than in white females. However, these findings do not mean that blacks and males have less dental disease, because it has been postulated that low-income fathers are less likely to seek dental care before their teeth literally fall out.

Friedman (6) noted a higher prevalence of full dentures in females than in males among the middle

and upper classes and explained it as an attempt to achieve dental esthetics. He called this attempt "mutilation by consensus."

Ingle (37) stressed that periodontal disease is chronic, relatively symptom free, and painless. It develops so gradually that the affected person usually is unaware of having it. Only in its advanced stages does the disease become bothersome, with loosening and drifting of teeth, bleeding gums, abscesses, bad breath, and finally loss of the teeth. For persons with injured heart valves, the disease may be life threatening because bacteremia from the oral cavity may lead to subacute bacterial endocarditis (SBE). The extraction of teeth with periodontal disease produces bacteremia and exposes the patient to SBE.

Another danger in treatment of advanced periodontal disease is the risk of death when teeth are extracted. Kincaid (51) reported that for every 10,000 admissions to hospitals for tooth extractions, 23 people die. No reliable figures are available for deaths in private practice and health clinics. Age and related factors probably contribute to this relatively high incidence of deaths. By comparison, the death risk in hospital procedures performed generally on younger patients, such as tonsillectomy and adenoidectomy, is less than 1 person (0.8) in 10,000 admissions. Deaths from extractions take on added significance when we consider that nearly 60 million teeth are extracted each year. According to the National Center for Vital Statistics, from 1949 to 1963 periodontal disease was implicated as the underlying cause in 900 of the 25 million deaths that occurred in those years (52).

Dentists believe, and with fairly convincing evidence, that most periodontal disease is preventable (37,53-57). Good oral hygiene with adequate plaque control, good nutrition, regular prophylaxes, and dental examinations form the basis of most prevention programs. It is unfortunate that about 40 percent of our children are not taught proper oral hygiene; these are the children who develop gingivitis that over the years leads to periodontitis and eventually to tooth loss.

Berenie and associates (58), in a well-controlled study, found that girls brushed more than boys and that 13 percent of the children brushed more than twice a day. The oral hygiene index decreased with the frequency of brushing, and the children with the poorest oral hygiene had the highest level of gingivitis. No statistical differences in the gingival index was observed among children who brushed one, two, or more times daily.

**Social impact.** Some aspects of social impact were mentioned in the previous section. The recent influx of social scientists into dental education and government activities related to dentistry has thus far been a mixed blessing, although with great promise for the future. Much of the information amassed revolves around the behavior patterns of patients, auxiliaries, and dentists.

We have information on the prevalence of dental disease, on morbidity, severity, age and sex distribution, on its relation to race, social and economic status, income, education, and occupation of patients. We know how to gather reproducible data by using a variety of indices to assess dental health, inflammation, bone loss, tooth mobility, and so on (53,59-76). What we do not know adequately is the economic and social impact of periodontal disease, because we do not know the attitude of society toward the disease and loss of teeth compared with society's other needs to live or to live well, or both.

Some progress has been made in the assessment of the need and demand for dental care, the quality of care rendered, and the behavior of the patient and the dentist and his team of auxiliaries (77-92).

Newman and Anderson (59) conducted a nationwide survey that revealed that although 46 percent of the population visit dentists in a given year, only 25-30 percent visit on a routine, periodic basis. Moreover, they found a direct and substantial relation between the levels of education, income, and occupation and the frequency of routine periodic visits.

Kegeles (60) found that most people believe that they are susceptible to dental caries, but only a small number think they are susceptible to periodontal disease. Also, most people do not see dental problems as interfering greatly with anything important to their lives.

Bellini and Gjermo (23) observed that, despite the overwhelming presence of periodontal disease, periodontal therapy has represented less than 3 percent of the total dental service provided to the U.S. population. Thus, a wide gap exists between treatment rendered and treatment needed (48).

We need to reduce the disparity that prevails between the existence of dental disease and the recognition of it as a health problem. Some researchers (93,94) believe that we need to adopt a mass media approach toward changing behavior. They cite the effectiveness of mass media in changing behavior—as seen in the acceptance and use of fluoridated toothpastes, which account for almost

two-thirds of all toothpastes sold today. The per capita consumption of toothpaste has increased 60 percent since 1955. If we assume that the amount of toothpaste used per brushing remained fairly constant, the increase reflects either more brushing per person or more persons brushing, or both. Other factors could have, and probably did, contribute to this increase. Nevertheless, it appears that the mass media, through commercial advertising, have influenced the dental health behavior of the public.

To demonstrate that even dentists do not practice what they believe, an audience of more than 100 dentists were asked to raise their hands if they believed that brushing after meals is helpful in preventing dental disease, and more than 95 percent did so. Then, all those who had brushed or swished and swallowed after the lunch they had just consumed were asked to raise their hands, and less than 30 percent did so.

People's beliefs are so imperfectly related to their actions that it may be more effective to use the kind of appeals used in advertising commercial products—"Good dental practices can save you money, make you more attractive, set a good example for your children, make you look like a movie star," for example—than rational arguments that emphasize the preventability and seriousness of periodontal disease.

A similar case has been made for dental health programs to change the behavior of school children. Dental health education efforts in schools have not yielded results commensurate with their apparent potential (95-97). The discrepancy in results may be due to presentation of information rather than a focus on persuasion (98-100). The dental practitioner should be an important resource in improving the preventive health behavior of his patients and through them the public. This role and the results obtained need critical analysis. We have little information about the effectiveness of dentists in inducing preventive behavior in their patients. Some studies have been reported on the management of orthodontic and denture patients, on progress in plaque control, and on prevention-oriented practices (101-103).

How effective are the practitioner's recommendations in changing patients' behavior? Are the behavioral and educational techniques in themselves effective, or is the dentist's enthusiasm for his recommendations more important than the specific communications? We do not yet know the answers to these questions (104).

Although it is widely held that an important responsibility of the dentist is to impress upon patients the importance of preventive measures, it is also widely held—as Corah (104) points out—that most people are already aware of the benefits of good oral hygiene and regular visits to the dentist. However, many people do not take these preventive measures. Hence, the real challenge is to influence and change patients' behavior, rather than just their professed attitudes and beliefs. On the other hand, if Wade's findings (105) that are the plaque scores and plaque control of dentists are worse than those of patients is true, the whole effort to change the behavior of patients is an exercise in futility.

**Economic impact.** The role of the health economist is to appraise health as an economic asset and to analyze ways in which the provision of health care "goods" and services affect the health of individual persons and the well-being of families and nations. Health economics is a relatively young field, and, again, there has been little direct study of the economic impact of periodontal disease.

Ingle (37) ingeniously used the number of services rendered by all dentists in 1969 to compute a dollar value for the total cost of dental services in that year. For example, 76,600,000 prophylaxes were done in 1969. If a modest value of \$10 per prophylaxis is assigned, the public spent \$766 million on prophylaxes in 1969. Similar calculations were made for periodontal treatment and restoration or replacement of teeth afflicted by or lost through the ravages of periodontal disease. The weakest link in the calculation was the determination of the role of periodontal disease in causing tooth loss and hence in the need for restorations, prosthetic appliances, X-rays, and other dental services. But Ingle was conservative in his "guesstimates" of this role and in assigning dollar values to each service. He arrived at a grand total for prevention, treatment, and home care of \$2.33 billion, excluding allocations for partial dentures or fixed bridges. The figures would be much higher today.

In fiscal year 1975, an average of \$35 was spent for dental services per person (106). This amount converts to \$7.7 billion for the U.S. population in 1975; it does not include the \$1 billion spent on oral hygiene aids (fig. 5).

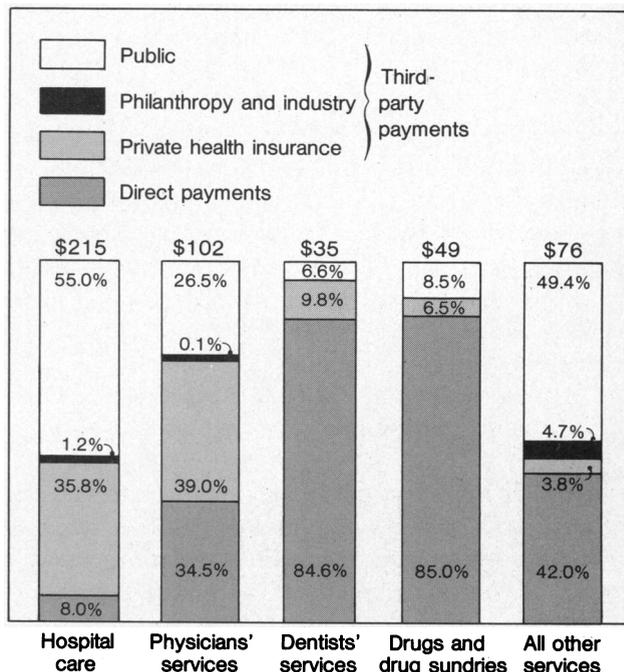
### Carnegie Council Report

If we are to meet tomorrow's challenges in dentistry and periodontics, we must examine the advice being

given to government by the experts in higher education. The Carnegie Council on Policy Studies in Higher Education published a book in 1976 (107) that issued "Three Warnings" and "Five Urgent Recommendations" about the progress and problems in medical and dental education. Much of the discussion centered around "Federal Support Versus Federal Control." Most of these warnings and recommendations are highly relevant to dentistry, and the following are some excerpts from them.

1. Only one new dental school is recommended. This school should be in Arizona. Maybe one more school will be needed in Florida in the future.
2. The solution to geographic maldistribution of health manpower and overspecialization in medicine should be through policies emphasizing incentives to effect the required changes rather than through excessive and unwieldy Federal controls. The Council believes ". . . that the primary need now is to encourage the training of dental auxiliaries and greater emphasis on education for primary-care dentistry."
3. The social benefits flowing from medical and dental education justify establishment by the Federal Government of a stable policy of financial support of university health science centers. This basic floor

Figure 5. Percentage distribution of per capita personal health care expenditures and sources of funds, fiscal year 1975



SOURCE: Reference 107.

of support can be supplemented by support from State governments and private sources.

4. The Federal Government should establish a combination of policies that provide positive incentives for physicians, dentists, and other health professionals to practice in underserved areas. Also, there should be more effective coordination among existing Federal programs and greater emphasis on Federal-State cooperation in overcoming geographic maldistribution.

5. Rather than establish complex Federal controls, the Federal Government should continue to provide incentives for students and schools to emphasize primary care training.

6. The Federal Government should pursue a stable and consistent policy of support of research in the health sciences. Increases in allocations should parallel the rise in real GNP. The funds allocated should cover full research costs and should advocate increased emphasis on ways of realizing greater efficiency in the training of health manpower and in the delivery of health care.

7. Major emphasis should be given to the development of more efficient and effective programs of health education. Indeed, the health professionals also need to be trained in educating patients to play a more active role in their own care and treatment.

### **Needs and Recommendations**

Answers to the following questions should be sought.  
—How much can be achieved by careful education and training of patients, both children and adults, in oral care?

—Does the use of various behavior change techniques add anything to training and gentle persuasion, and which, if any, of these techniques are morally acceptable to the dental profession?

—By which mechanism do some dentists succeed in influencing their patients? How does their patients' behavior compare with that of similar patients whose dentists do not urge them to practice good oral hygiene?

—Do patients respond to information and persuasion from paraprofessionals as well as they do from dentists?

—What is the effect of periodontal disease and loss of teeth on a person's attitude toward his or her state of health, self-esteem, interpersonal relations, and job success? What is the effect on the person's quality of life?

—How much absenteeism from work and other responsibilities occurs as a result of periodontal disease or treatment?

—How can we change the public's perceptions about periodontal disease and persuade people who do not now practice preventive dental behavior to do so?

There is a need for the following:

—Indicators that will provide adequate measures to assess the social impact of dental disease. Currently, we have no indicators that reflect the (negative) value society places on various stages of oral disease and disorders. Anchor points are needed for valid assessment in this area (38).

—Use of appropriate models for assessing treatment needs, such as the model devised by a WHO expert committee on dental health planning (39); this and other models could be used to determine where we have relevant research and where we do not, for both retrospective and prospective studies. For example, a study that compares the characteristics of samples of edentulous and dentulous persons matched by socioeconomic status and age could provide some starting points for the development of the hypotheses in this field. The key here would be matching by known demographic traits that seem related to periodontal disease.

—Retrospective studies on data now in dental offices and clinics throughout the country (treatment records, medical and dental histories, charts, and X-rays). For example, what is the course of tooth retention versus loss in partial-denture wearers when sex, race, type of partial denture, and frequency of checkups are considered?

—Cross-sectional studies relating current demographic data with periodontal disease as associated with age, sex, diet, race, oral hygiene, education (socioeconomic status), and occupation.

—Genetic studies that use the new developments in the field.

—Cost-benefit studies with special attention to prevention and treatment procedures that can be provided on a mass scale at an affordable cost.

—A battery of studies to get detailed information about the characteristics of persons who retain their teeth and show little or no evidence of gingival recession or bone loss. What is their nutritional status, diet, heredity, biochemistry, geographic location, oral hygiene, marital status, occupation, income, and degree of happiness?

—National and international collaborative studies to clarify "adequate health care," with a clear delineation of the roles of dentists and patients as participants and partners in early detection and treatment of periodontal disease. Means for better education of

patients and their assumption of responsibility for maintenance of their state of health are needed.

In sum, there is a great need for longitudinal studies of child and adult dental behavior, not only per se, but also in relation to the general health behavior of individual persons and families. A sharp focus is needed on research that will contribute clearly to the formulation of clear components of dental health education programs.

National and international organizations, such as the Federation Dentaire Internationale, the American Dental Association, and the World Health Organization, should initiate collaborative studies. These studies should not only identify the social and economic impact of periodontal disease, but they should also determine cost benefits and cost effectiveness of existing programs so that new, more effective, and more efficient programs can be proposed.

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