Global epidemiology of periodontal diseases: an overview

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This volume aims to provide a comprehensive evaluation of the distribution of various types of periodontal diseases from each of the world’s five major geographic regions. Epidemiology is the study of the health and disease in populations, as compared to individuals (20). Study of the distribution of human periodontal diseases and their risk factors on a global scale offers a unique investigational model that can provide power and generalization to observations on the periodontium made initially among more limited populations. In assessing causation between periodontal diseases and their suspected etiologic risk factors, it is useful to demonstrate consistency of the relationships in multiple, representative population samples. When diverse study approaches in various populations by different investigators produce similar conclusions on the distribution of periodontal diseases and/or their associations with putative risk factors, then one can be more confident that real phenomenon and/or causal relationships exist (29). Indeed, population-based studies provide external validity to observations obtained from more discrete subject groups, and enable generalization of the conclusions (14). Alternatively, differences in periodontal disease patterns among various population groups can be exploited to uncover previously unidentified risk factors that may not be expressed in all populations.

Available population-based periodontal disease data originate from studies encompassing a wide range of objectives, designs and measurement criteria (18). The lack of standardized study design, definition of periodontal disease status, methods for disease detection and measurement, and criteria for subject selection markedly limit interpretation and analysis of available population-based periodontal disease data from around the world. However, several broad trends on the nature of human periodontal diseases are apparent across the wide range of population-based data.

Population studies confirm the close relationship between dental plaque and gingivitis that was initially described by Löe et al. (21) in nonpopulation-based studies. Throughout the globe, dental plaque growth and inflammation of gingival tissue are ubiquitous and strongly linked, irrespective of age, gender or racial/ethnic identification. More than 82% of U.S. adolescents have overt gingivitis and signs of gingival bleeding (2), with similar or higher prevalences of gingivitis being reported for children and adolescents in other parts of the world (4, 12, 13, 15, 25). A high prevalence of gingivitis is also found in adults, with more than half of the U.S. adult population estimated to exhibit gingival bleeding (1, 6, 24), and other populations showing even higher levels of gingival inflammation (25).

While gingivitis parallels the level of oral hygiene in a population, it is by itself a poor predictor of subsequent periodontitis disease activity (5, 16, 19). However, young subjects with overt gingival inflammation more frequently exhibit periodontal attachment loss than adolescents without gingival inflammation (2). Furthermore, gingivitis always appears to precede the development of periodontitis, as no data from around the world indicate that the onset of periodontitis occurs without gingival inflammation.

It is clear from global epidemiology data that a less pronounced relationship appears to exist between dental plaque and severe periodontitis. Severe forms of human periodontitis frequently affect only a sub-
set of population groups globally, even though plaque-induced gingivitis and slight to moderate forms of periodontitis are widespread within the same population groups. A relatively small subset of populations in the United States (6), Central and South America (15), Europe (27), Africa (7), and Asia/Oceania (10) exhibit severe forms of periodontal attachment loss with deep periodontal pocket formation. The relatively lower occurrence of severe periodontitis in many of the studied populations may in part be attributed to the lack of standardized study design and disease measurement criteria used, and the effects of marked tooth loss in persons with severe periodontitis, which would serve to reduce the prevalence of severe periodontitis as edentulous conditions occur. However, it is likely that additional, unidentified risk factors beyond dental plaque and gingivitis alone are important in the onset and pathogenesis of severe forms of periodontitis.

In this regard, the relative contribution of various proposed risk factors in severe periodontitis remain to be fully delineated. Most studies fail to assess aspects of study subjects (i.e. genetic, biochemical, microbiologic and/or immunologic markers) beyond basic demographic characteristics. There is a relative paucity of analytic studies which account for a wide range of potential independent risk factors for severe periodontitis. For example, several gene polymorphisms have been investigated relative to their associations with periodontitis, and some of these have been shown to be related to increased risk for aggressive disease (5). The most significant gene aberrations studied so far are those thought to be associated with altered host immune response to infection, including interleukin-1 (IL-1) gene, vitamin D receptor gene, and fMLP receptor gene.

However, the effects of various genetic risk factors are not exclusive, and these effects explain only a part of the variance in the occurrence of aggressive periodontitis, and to a lesser degree, chronic periodontitis. Studies show that there is a significant interaction between genetic factors and other environmental and demographic factors, including a possible modifying effect of smoking, and a variability in the occurrence of certain genotypes in different race-ethnicity groups (5). Hence, more analytic studies encompassing a wider range of potential risk variables are needed to better understand the role of these and other factors in the increased susceptibility to destructive periodontal diseases.

Another problem with many population-based periodontal studies has been the reliance upon measurement of probing depth as an indicator of disease status. At a population level, probing pocket depth measurements are of limited value for the appraisal of the extent and severity of periodontal diseases for the following reasons:

- An increase in the probing depth at a given tooth site may or may not be associated with attachment loss at that site.
- The probing pocket depth at a given site is a changeable measure. A reduction of the probing depth with aging due to gingival recession is frequently observed (22), and does not necessarily indicate improved periodontal status.
- Probing depth does not provide an accurate measure of periodontal tissue destruction accumulated over a person's lifetime as reliably as assessments of periodontal attachment level.

Significant disparities appear to exist in the level of periodontitis among young, adult and senior populations in the world. Subjects of African ethnicity seem to have the highest prevalence of periodontitis, followed by Hispanics and Asians. Disparities in periodontal status appear to occur largely between the poor and the rich. Populations with a lower socioeconomic level cannot afford dental treatment. These populations often lack healthy attitudes and behaviors for oral health, as well as for systemic health. In addition, periodontal disease susceptibility is further aggravated by the apparent occurrence in these populations of certain biological and microbiological risk factors that further increase their predisposition to periodontal diseases (3, 5).

Epidemiologic data can form the basis for selection and implementation of strategies to prevent and treat periodontal diseases. Three broad strategies have been advanced (26, 28):

- **Population strategy**: uses a community-wide approach in which health education and other favorable life practices are introduced in the community, and unfavorable behaviors are attempted to be changed.
- **Secondary prevention strategy**: includes detecting and treating individuals with destructive periodontal diseases. Basically, health education is an integral part of this strategy, although it is more customized to the needs of the individual patient. Dental health education approaches to improve the oral hygiene of the individual patient, al-
though successful in the short-term, have been shown to be relatively ineffective in making sustained changes in oral hygiene behaviors (27). This may be partly due to the failure to incorporate social contextual factors and other factors, such as loss of function and esthetics, and the general health impact of periodontal diseases, in these programs.

- Identification of high risk groups for periodontitis: the early detection of active disease and identification of subjects and groups who are more likely to develop destructive periodontal diseases in the future are important elements of dental care systems planning.

The selection of the most appropriate of the above strategies for a given population group is dependent upon the disease distribution and nature of risk factors pertinent to periodontal diseases in that particular population.

In the future, adoption of better oral hygiene should have a notable impact on the occurrence of periodontal disease. Awareness of the occurrence of disease, the infectious nature of these diseases, and the available means of risk assessment and disease prevention (11, 23), may be achieved through a better interaction between oral health providers and community decision makers, and changes in the educational programs in the population to promote healthy attitudes. The advent of fluoride and its effect in markedly reducing the incidence of dental caries has resulted in a notable increase in tooth retention worldwide (9), and a higher number of retained teeth may be accompanied by increases in the prevalence and severity of periodontal attachment loss in the population (17). Finally, as more people are living longer, with retention of their teeth, a greater prevalence of destructive periodontal disease may be expected to occur (8).

Although behavioral changes, including better oral hygiene habits, smoking cessation programs, and other behavioral and promotional programs may potentially improve periodontal health, the overall benefits may be offset and even surpassed by the increases in the prevalence and severity of periodontal attachment loss which will accompany the anticipated increase in tooth retention and longer life expectancy. In the coming years on a global basis, it may be foreseen that a decrease in prevalence and severity of periodontal attachment loss in populations younger than 50 years is likely together with an increase in periodontal disease in older age groups.

References