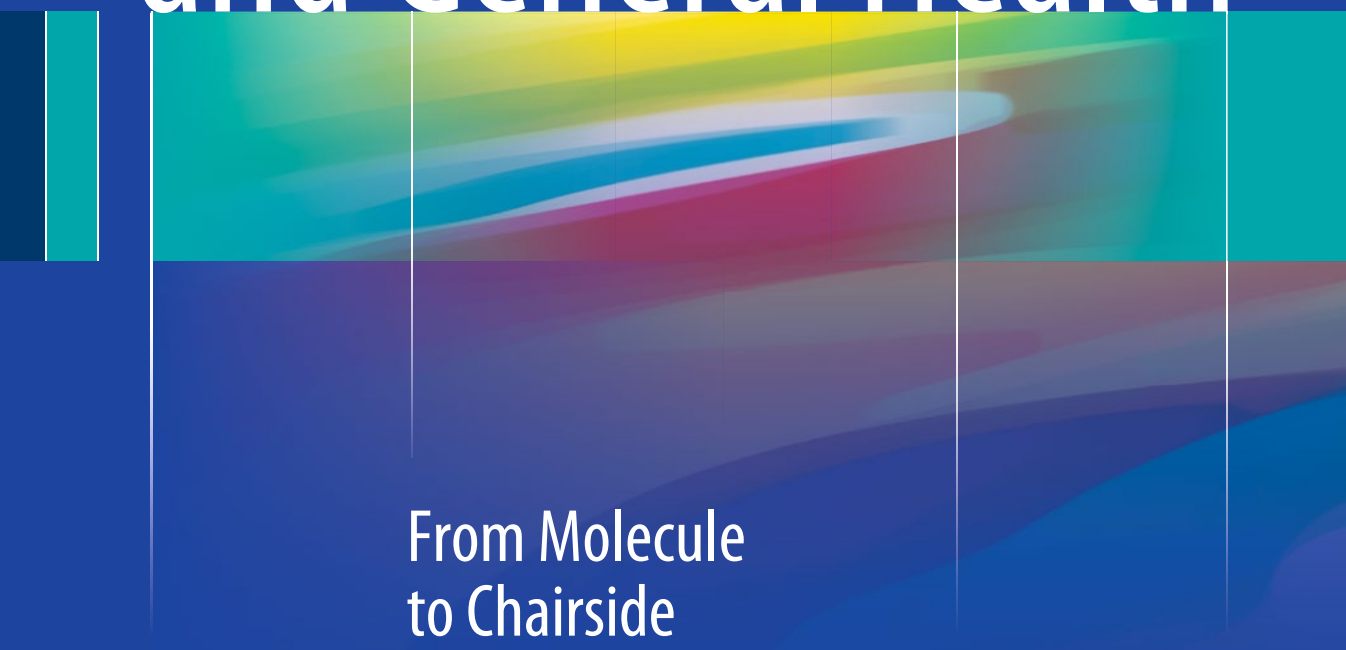
Anne Marie Lynge Pedersen
Editor

Oral Infections and General Health

From Molecule to Chairside



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About the Editor

Anne Marie Lynge Pedersen, DDS, PhD, is Associate Professor and Head of the Department of Odontology in the Faculty of Health and Medical Sciences, University of Copenhagen, Denmark. Dr. Pedersen graduated in 1992 from the Royal Dental College, Copenhagen, Denmark, and gained her PhD from the University of Copenhagen in 1997 for a thesis entitled *Salivary gland dysfunction in patients with primary Sjögren's syndrome*. She then joined the Section of Oral Physiology and Oral Pathology & Medicine, Department of Odontology, University of Copenhagen, as a research assistant, and progressed to become head of the department in 2013. From 2009 to 2012, Dr. Pedersen was Vice President and board member of the Scandinavian Division of the International Association of Dental Research (IADR), and she became President of the Division in January 2013. She has also served as an appointed board member of the Danish Dental Association Research Foundation (2007–2013) and acts as a consultant to the Danish Dental Association on topics such as xerostomia, salivary gland function, oral mucosal diseases, and pharmacology. Dr. Pedersen has been the organizer of national and international conferences, seminars, and symposia and is a referee for many leading international scientific journals.

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Part I

Background Topics

Introduction

1

Anne Marie Lynge Pedersen

Abstract

The idea for this book came about in relation to a symposium organized by the editor to present a research update that summarizes new findings related to the oral microbiota and the interaction between oral infections and general health. The symposium was held at the Annual Meeting of the IADR Continental European Division (CED) and Scandinavian Division (NOF) in Florence, Italy, in 2013. Consequently, the content of this book is largely based on contributions from European researchers within the field, but nonetheless the science presented in the various chapters embodies the global aspects of the topic and is therefore of significant relevance for researchers as well as health-care professionals throughout the whole world.

The healthy oral cavity is normally colonized by bacteria, fungi, and viruses. It has been estimated that more than 600 bacterial species colonize the oral cavity of which some may be pathogenic and others are symbiotic or commensal. The normal oral microbiota may be disrupted by a large number of factors including poor diet, malnutrition, poor oral hygiene, tobacco smoking and alcohol consumption, but also by several systemic diseases as well as the medications used for treating them, especially those associated with immunosuppression and/or salivary gland dysfunction. A disturbance of the balance between the oral microbiota and the host immune system results in a shift from a healthy state to a diseased state leading to inflammation and infections of the oral hard and/or soft tissues. The most common oral infectious diseases include dental caries, periodontal disease, and oral candidiasis.

Dental caries is one of the most prevalent diseases in humans. Even though the incidence of dental caries has decreased during the last decades, it is still a major problem in most industrialized countries as it affects 60–90 % of school-aged children and the vast majority of adults and obviously a larger problem in developing countries with poor living conditions and limited availability and accessibility of oral health services. In Chap. 2, Professor Twetman reviews

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a number of systemic diseases that are associated with an increased frequency of dental caries. As stated by the author, there are still obvious gaps of knowledge concerning the interaction between caries and general diseases which calls for further studies covering risk factors, associations, as well as cost-effective interventions.

Periodontitis is a serious oral infection, which is estimated to affect 15–20 % of the adult populations worldwide. Severe periodontitis may lead to premature tooth loss. Furthermore, most children and adolescents worldwide display signs of gingivitis. An increasing number of studies have suggested that oral infection, especially marginal and apical periodontitis, may affect the course and pathogenesis of a variety of clinically important systemic diseases. In Chap. 3, Professor Bruno Loos reviews current knowledge on the inflammatory mechanisms linking periodontal diseases to cardiovascular diseases. In the past decades a large number of studies have also demonstrated a linkage between periodontitis and diabetes mellitus. This linkage appears to be bidirectional. The proposed mechanisms or pathways by which these two diseases interact are reviewed by Professor Palle Holmstrup and Allan Flyvbjerg in Chap. 4. A possible two-way interrelationship has also been suggested for periodontitis and rheumatoid arthritis which is described in details by Professor Palle Holmstrup and Claus Nielsen in Chap. 5. Possible mechanisms behind the systemic effect include spreading of bacteria present in the periodontal pockets as a result of transient bacteremia and release of circulating oral microbial toxins and pro-inflammatory mediators caused by immunological injury induced by oral microorganisms. Insidious dental infections can worsen the condition and turn out to be life threatening in immunocompromised patients like recipients of kidney and liver organs. Consequently, oral infections should be diagnosed and properly treated before as well as during and after organ transplantation. Chap. 6 by Professor Jukka H. Meurman addresses the associations between dental infections and liver and renal diseases. According to WHO, the number of cancers is estimated to increase by 70 % by the year 2030 due to the aging of the populations. The prevalence of oral cancer is particularly high among men, and it is the eighth most common cancer worldwide. Recent research suggests that oral infections may play a role in the development of cancer. In Chap. 7, Professor Jukka H. Meurman reviews current knowledge on the mechanisms by which oral infections may influence the process of carcinogenesis.

Oral candidiasis is a common opportunistic infection usually caused by the overgrowth of *Candida* species. There are several predisposing to oral candidiasis including use of antibiotics, steroid inhalers or systemic steroids, high-carbohydrate diet, malnutrition, smoking, wearing dentures, and impaired salivary gland function. The prevalence of oral candidiasis is high in immunocompromised patients such as patients with HIV infection, Sjögren's syndrome, malignancies, and diabetes. Hence fungal infections are becoming a serious public health problem, particularly for the growing population of elderly people, immunocompromised patients, as well as patients with salivary gland dysfunction. Although the introduction of highly active antiretroviral therapy (HAART) has made oral candidiasis less common, HIV-associated oral lesions still remain significant with oral candidiasis as the most typical lesion. An update on oral candidiasis in medically compromised patients and the various current methods used to diagnose oral candidiasis, their advantages and disadvantages, as well as with new perspectives in using molecular techniques is given by Associate Professor Camilla Kragelund and coworkers in Chap. 8.

The last chapter in part II deals with the influence of salivary gland dysfunction, i.e., affection of the quantity and quality of saliva, on the occurrence of oral infections. In Chap. 9, Associate Professor Siri Beier Jensen and Anne Marie Lynge Pedersen review the most conditions associated with severe salivary gland dysfunction and their influence on oral health, i.e., Sjögren's syndrome, cancer therapy, and intake of medications.

Emerging knowledge on the oral microbiota challenges the current practice of chairside diagnostics. A number of new molecular techniques

are now used to analyze the microbiome in health and disease including HOMINGS, oligotyping, high-throughput sequencing, whole genome shotgun sequencing, single-cell genome sequencing, metatranscriptomics, and community-wide transcriptome analysis. Chap. 10, part III, by Professor Ingar Olson deals with the human oral microbiome which contains bacteria, bacteriophages/viruses, archaea, fungi, and protozoa, in health and common oral diseases. The salivary microbiota is a highly complex microbial community, containing oral microorganisms shed from various oral surfaces. Saliva can be easily and noninvasively collected, and compositional changes of the salivary microbiota may potentially serve as a biomarker used for screening of oral and systemic diseases as reviewed by Assistant Professor Daniel Belström in Chap. 11.

The final part of the book addresses recent research in treating or even preventing oral infections. The field of using probiotics is promising and may offer a novel approach of future handling oral functions as reviewed by Dr. Mette Rose Jørgensen and Associate Professor Mette K. Keller (Chap. 12). Also the management of patients with oral candidiasis is dealt with in this part of the book, in Chap. 13 by Associate Professor Camilla Kragelund and coworkers.

As we discover in this book, it seems justified to state that good oral health is important not only to prevent oral diseases but also to maintain good general health and vice versa.