Graduate project at the Department of Periodontology, Institute of Odontology, The Sahlgrenska Academy at University of Gothenburg

**Periodontitis and peri-implantitis. Clinical and experimental studies**  
(Parodontit och peri-implantit. Kliniska och experimenterliga studier)

Severe forms of chronic periodontitis affect about 10% of adults and are characterized by inflammatory lesions in the gingiva and associated destructive processes in the periodontal tissues. Such processes result in loss of connective tissue attachment and supporting bone. Inflammatory lesions that occur in the tissues surrounding implants (peri-implantitis) exhibit histopathological features similar, but not identical, to those in periodontitis.

The current research plan is part of a major research project the objective of which is to unravel why some subjects are more susceptible to periodontitis and peri-implantitis. The work will be performed within the Department of Periodontology, The Sahlgrenska Academy at University of Gothenburg and will include clinical documentation and collection of samples from subjects with severe chronic periodontitis and peri-implantitis. Animal experiments may also be included and the material to be obtained representing periodontitis and peri-implantitis lesions will be used as models to study host-parasite interactions in situ.

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**Co-supervisors:** Professor Gunnar Dahlén (Department of Microbiology) and Docent Ingemar Abrahamsson (Department of Periodontology).

**Project description**

**Chronic periodontitis**

The periodontitis lesion occurs as a response to a subgingival biofilm. Leukocytes and/or their products, which are associated with tissue destruction, are controlled by immunoregulatory mechanisms. The equilibrium or imbalance established between microorganisms and the inflammatory process determines the severity and progression of the periodontitis lesion. Although lymphocytes and plasma cells dominate among cells in periodontitis lesions B-cells appear to be one of the most important cells, as they are involved in several immune-regulation functions such as antigen-presentation, disease progression and tissue destruction. Autoreactive B (B-1a) cells are of particular interest together with the interaction of interleukin-10 in the regulation of periodontitis lesions. About 30-80% of the population variance in periodontal disease is attributed to genetic factors. Studies on different single nucleotide polymorphisms (SNPs) related to the function of cytokines have demonstrated varying degree of association with periodontitis and genes encoding for IL-1, IL-10, and Fc-gamma receptors are associated with periodontitis in certain ethnic groups.

**Peri-implantitis**

Biological complications at dental implants, i.e. processes that compromise tissue integration to implants during function, are more frequent than previously understood. Results reported in recent cross-sectional studies revealed that the prevalence of peri-implantitis varied between 28
and 56 % of implant treated subjects. Susceptibility to periodontitis is a risk in implant therapy and such subjects exhibit a greater risk for implant loss and peri-implantitis.

**Experimental models**

Ligature-induced breakdown of periodontal and peri-implant tissues in dogs is a well-described and commonly used experimental model to study mechanisms involved in tissue destruction. The dog model has several advantages in relation to other animals. Thus, the dog is susceptible to periodontal disease and the jaws are large enough to allow the use of standard types of dental implants in designated areas. We recently further developed the dog model to include the study of spontaneous progression of peri-implantitis. Thus, following ligature removal and ongoing plaque accumulation at implants, inflammation persisted in the peri-implant tissues and destruction of supporting bone and connective tissue continued.

**Overall objective**

The objective of the present project is to study local and systemic immunological features in subjects with (i) severe, generalized chronic periodontitis (ii) gingivitis but no loss of attachment (subjects resistant to periodontitis) and (iii) destructive inflammatory processes around implants (peri-implantitis).

**Specific Aims:**

- **Study 1:** To (i) examine cytokine-associated genetic polymorphisms and the expression of corresponding cytokines in periodontitis lesions, (ii) to compare periodontitis lesions (periodontitis subjects) with inflammatory lesions in gingival tissues without attachment loss (subjects resistant to periodontitis) regarding distribution of lymphocyte populations including B-1a cells and cytokines involved in immune-regulation and tissue destruction.

- **Study 2:** To analyze gene expression of regulatory cytokines, MMPs, RANK-L, OPG in cells isolated from gingival lesions and from peripheral blood of subjects recruited in study 1.

- **Study 3:** To analyze (i) histological and microbiological characteristics of human peri-implantitis lesions and (ii) examine cytokine-associated genetic polymorphisms and the expression of corresponding cytokines in peri-implantitis lesions.

- **Study 4:** To study mechanisms involved in tissue destruction in experimentally induced periodontitis and peri-implantitis in dogs.

**Significance**

The information on host response features in periodontitis susceptible individuals may not only be used as markers of susceptibility but may also serve as guidelines for new possible interventions of cell-mediated regulations in periodontitis. Factors related to susceptibility to periodontitis in the assessments of the risk for peri-implantitis and implant loss will be elucidated.

**Short CV**

Tord Berglundh, DDS, Odont Dr.
Professor

Dr. Tord Berglundh graduated (LDS) 1978 in Göteborg and received his certificate as specialist in Periodontics in 1992, the degree of Odont. Dr. (PhD) in 1993, the Docent (Associate professor) degree in 1994 and the Professor degree in 2002 from the Department of Periodontology, The Sahlgrenska Academy at University of Gothenburg, where he has served since 1981.

Presently, Dr. Berglundh is Professor at the Department of Periodontology, The Sahlgrenska Academy at University of Gothenburg and the Head of the Periodontal Research Laboratory. He is Associate Editor of *Clinical Oral Implants Research* and serves as a referee in several other journals.

Dr. Berglundh has produced about 150 scientific publications within the field of dental implants, periodontology, immunology, tissue integration and regeneration. The studies on implants have included different implant systems, compromised sites and diagnosis/treatment of peri-implantitis lesions.