engineering proceedings

MDPI

Proceedings Paper

A novel surface plasmon resonance-based optical biosensor for point-of-care detection of periodontal biomarkers.

Annunziata M.[1], Arcadio F.[2], Borriello A.[3], Bencivenga D.[3], Piccirillo A.[1*], Stampone E.[3], Zeni L.[2], Cennamo N.[2], Della Ragione F.[3] and Guida L.[1]

[1] Multidisciplinary Department of Medical-Surgical and Dental Specialties, University of Campania "Luigi Vanvitelli", Via L. De Crecchio, 6, 80138 Naples, Italy.
[2] Department of Engineering, University of Campania Luigi Vanvitelli, Via Roma 29, 81031 Aversa, Italy.
[3] Department of Precision Medicine, University of Campania "Luigi Vanvitelli", Via L. De Crecchio 7, 80138 Naples, Italy.
*Presenting author.

Different analytes have been proposed as biomarkers of periodontitis, such as macrophage inflammatory protein (MIP-1α) and matrix metalloproteinase-8 (MMP-8). The aim of this proof-of-concept study is to test a novel highly sensitive point-of-care test (POCT), based on an optical biosensor exploiting the principles of surface plasmon resonance (SPR), for the analysis of salivary MIP-1α and MMP-8.

Antibody self-assembled monolayers (SAMs) for plasmonic detection of MIP-1α and MMP-8 were realized on suitably modified plastic optical fibers. Biomarker levels were quantified by analysing the shift of the resonance wavelength of a white light source determined by the specific antigen-antibody binding upon the SAM and detected by a spectrometer connected to the biosensor.

Dose-response curves were realized by serial dilutions of human recombinant MIP-1α and MMP-8 in both PBS (phosphate buffered saline) and real matrix (saliva), showing a very low limit of detection (LOD) and a high selectivity. It was also possible to discriminate, by measuring the biomarker salivary levels, between a periodontitis patient and a periodontally healthy subject.

The present SPR-based POCT demonstrated to be employable to detect and quantify MIP-1α and MMP-8 levels in both buffer solution and saliva with low LOD and high selectivity, opening interesting perspectives for future clinical applications in terms of on-site detection and real-time monitoring of periodontal health conditions, early diagnosis, as well as timely and targeted therapy of periodontitis.