

Prediction for Periodontists by Oral Bacteria in Korean

2020 1st Semester Interdisciplinary Project

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June 1, 2020

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1 Introduction

1.1 Periodontitis

Periodontitis is an inflammatory disease of the periodontium which is characterized by a progressive destruction of the tissues supporting the tooth [2]. In histopathologically, periodontitis may result periodontal pocketing, location of junctional epithelium apical to the cemento-enamel junction, loss of collagen fibers subjacent to the pocket epithelium, numerous poly-morphonuclear leukocytes in epithelium and a dense inflammatory cell infiltrate with plasma cells, lymphocytes, and macrophages [3]. Periodontitis is currently assumed to progress as periodic, relatively short episodes of rapid tissue destruction followed by some prolonged intervening periods of disease remission [2].

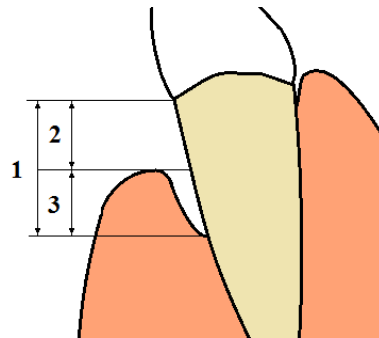


Figure 1: Diagram of Gingival Recession [1]

Periodontitis is diagnosed by measuring clinical attachment loss (CAL). Note that the CAL is the length of the figure 1-1, which is sum of gingival recession (GR) in figure 1-2, and probing depth (PD) in figure 1-3.

Periodontitis is generally believed to be a result of a host-parasite interaction in which bacteria are the determinants of periodontitis [4]. In etiology, the primary cause of periodontitis is presumed as a bacterial infection as the primary cause of periodontitis [3]. Thus, the treatment of periodontitis includes antibiotics and dental surgery.

In this manner, some medicines have been introduced for treatment. However, the success in the prevention and treatment of periodontitis has been limited. Many *in vitro* studies shows that Asian have the different bacteria from non-Asian, due to their groceries [5]. Thus, the developments of plaque and calculus in Asian differ, and may lead to distant reactions between Asian and non-Asian.

1.2 Machine Learning

Machine learning is the study of algorithms which advance spontaneously through experience. Machine learning is conjugated where is infeasible with conventional algorithms such as computer vision. Many papers show that machine learning brings out better result than human recognition.

If the feedback provides the correct answer for specific inputs, then learning problem is called supervised learning [6]. Classification is a kind of supervised learning for discrete values; regression is for continuous values.

1.3 Purpose of Research

There are many studies which have tried to find bacteria as bio-markers [7, 8]. Most of these papers, though, researched in Western people [9, 10]. As I mentioned herein-above, oral bacteria population may differ between Western and non-Western. In this approach, therefore, prediction periodontitis from machine learning which based on oral bacteria population of Korean is required.

Hence, the purposes of this research are as:

1. Classify the stage of periodontitis by oral bacteria.
2. Regress the CAL, the GR, or the PD by oral bacteria.

2 Materials

3 Methods

The entire program is disclosed by GitHub in https://github.com/Fumire/Periodontist_Fall2019.

3.1 Python Packages

Python programming language had been used to analyze data. Also, many Python modules had been adopted as hereinafter.

3.1.1 Pandas

Pandas is a Python library of rich data structures and tools for working with structured data sets common to statistics, finances, social sciences, and many other fields [11].

3.1.2 Scikit-learn: Machine Learning in Python

Scikit-learn is a Python module integrating a wide range of state-of-the-art machine learning algorithms for medium-scale supervised and unsupervised problems [12]. Also, the following algorithms amongst *Scikit-learn* package are used:

- AdaBoost
- Adam Neural Network
- DecisionTree
- K-Neighbors
- LBFGS Neural Network
- Linear SVC
- Poly SVC
- Random Forest
- RBF SVC
- Sigmoid SVC

3.1.3 Seaborn

Seaborn is a Python data visualization library based on *matplotlib*. It provides a high-level interface for drawing attractive and informative statistics graphics [13].

3.2 Stages of Periodontitis

There are five clinical stages of periodontitis as table 1.

Table 1: Clinical Stages of Periodontitis

Kinds	Stages
Healthy	Healthy
	Slight
Chronic	Moderate
	Severe
Acute	Acute

4 Results

5 Discussion

6 Acknowledgment

The relative study which based on the identical data has been submitted *American Society for Microbiology* as "Prediction of chronic periodontitis severity using machine learning models based on salivary bacterial copy number".

I thank all study subjects for their generous participation and the clinicians for their contributions leading to the successful completion of this study. This work was partly supported by the Technological Innovation R&D Program (C0445482), funded by the Small and Medium business Administration (SMBA, Republic of Korea). This work also partly supported by the Next-Generation Information Computing Development Program of the National Research Foundation of Korea funded by the Ministry of Science and ICT (NRF-2016M3C4A7952635). This research work was also partly supported by the National Research Foundation (NRF) of Korea grant NRF-2017M3A9B6062026, funded by the government of Republic of Korea. I would like to thank David Whee-Young Choi for constructive criticism of the manuscript.

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