

Assessment of Oxidative Stress in Periodontitis Patients

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Abstract

Aim: To assess the oxidative stress markers between normal and periodontitis patients.

Materials And Methods: A total of 20 samples were used in the study. They were in the age group of 39-53 years old. Of these, 10 patients were healthy controls and 10 patients had severe periodontitis. The levels of MDA and SOD parameters were analysed among both types of patients.

Statistical Analysis: Data were analysed by Independent t test and Mann-Whitney test.

Results: Data analysis shows that patients with periodontitis had lower values of SOD and higher values of MDA whereas healthy patients had higher levels of SOD and lower levels of MDA.

Keywords: oxidative stress, periodontitis, MDA (Malondialdehyde), SOD (Superoxide dismutase).

INTRODUCTION

Periodontitis is a chronic inflammatory disease, characterised by gingival bleeding, periodontal pocket formation, connective tissue destruction and alveolar bone resorption leading to tooth loss [1]. Studies have demonstrated that periodontal disease affects between 10% and 15% of the world's population, representing the greatest cause of tooth loss [2]. The pathological events which lead to the destruction of the periodontium during inflammatory periodontal disease have been related to the effect of the imbalance between oxidants and antioxidants in patients with periodontal disease [4,5]. ROS are generated predominantly by Polymorph nuclear leukocytes [PMN] during an inflammatory response [4].

Oxidative stress has been implicated as a major contributor in over 100 disorders and more recently periodontitis [3]. The deleterious effects of increased oxidative stress are termed oxidative damage; generally appear after exposure to a relatively high concentration of reactive oxygen species (ROS) and/or a decrease in antioxidant (AO) defense system against ROS.

Oxidative stress has been variably determined by the measurement of a decrease in total antioxidant capacity or more often, by estimation of the products of oxidative damage to lipids, proteins and DNA. Measurement of the products of oxidative damage can provide the most direct assessment of oxidative stress. [6, 7]

Few oxidative stress markers are MDA, SOD, NO, GPx, GST, GSSG, MPO. Malondialdehyde (MDA) is the principal and most studied product of polyunsaturated fatty acid peroxidation that can indicate the increase of oxidative stress. [8,9]. Other studies [10] have found that gingival SOD activity is significantly higher in chronic periodontitis (CP), which suggested that SOD activity increases with the progression of inflammation.

The aim of this study was to evaluate the major two oxidative markers - MDA and SOD which is increased during oxidative stress levels in individuals with periodontal disease.

MATERIALS AND METHODS

The present study was done under 10 healthy patients and in 10 periodontitis patients. The oxidative stress markers were experimented in their serum in both the type of patients.

The oxidative stress markers used were:

1. MDA (Malondialdehyde)

3ml of venous blood is collected in an EDTA containing tube. Then blood is centrifuged and plasma is separated and analyzed MDA by HPLC method.

2. SOD (Superoxide dismutase)

3ml of venous blood is collected and centrifuged. Serum is separated and analyzed by ELISA method.

The statistical analysis for MDA was done using the Mann-Whitney test and for SOD using independent t-test. The data was expressed as Mean \pm standard deviation.

TABLE: The serum level of antioxidant capacity of Malondialdehyde, Superoxide dismutase in healthy and periodontitis patients.

Parameters	Normal		Periodontitis		Significance
	Mean	Standard deviation	Mean	Standard deviation	
MDA	0.38	0.23	2.64	1.24	0.000***
SOD	65.86	16.40	30.64	7.30	0.000***

*** (p<0.001)

RESULTS

The results from the above table shows that:

- Using Mean-Whitney test, there is significant difference between periodontitis and normal patients at $p < 0.001$ in MDA levels.
- Using Independent t-test ,there is significant difference between periodontitis and normal patients at $p < 0.001$ in SOD levels.

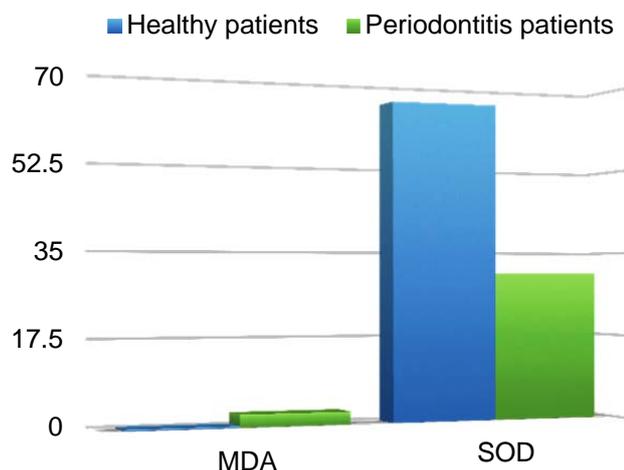


Fig-(1) The mean value of MDA and SOD in healthy and periodontitis patients.

DISCUSSIONS

Diseases of the periodontal tissues are among the most widespread inflammatory disorders worldwide and are a major cause of tooth loss in the adult population [11]. Furthermore, because recent studies suggested that systemic risk factors for periodontitis, i.e., regular smoking, diabetes mellitus or inappropriate nutrition, were associated with high levels of oxidative stress [12-15]

Regular smoking and systemic diseases such as diabetes mellitus, which are known risk factors for periodontitis, increase circulating oxidative stress [16,17]. Oxidative stress plays a crucial role in the pathology of a number of diseases, including arthritis, atherosclerosis, adult respiratory distress syndrome, heart diseases, stroke, acquired immunodeficiency syndrome, Alzheimer's disease, Parkinson's disease, and liver diseases [18-20].

In this study we see that there is significant differences between healthy and periodontitis patients in their MDA and SOD levels using statistical analysis. The mean standard deviation in normal patients was found to be 0.38 ± 0.23 in SOD and 65.86 ± 16.40 in MDA levels whereas in periodontitis patients it is found to be 2.64 ± 1.24 in SOD and 30.64 ± 7.30 in MDA levels.

The normal range for MDA is $< 1 \mu\text{mol/L}$ and the normal value for SOD ranges from 40-120 ng/ml. This study reveals that the levels of oxidative stress is due to the increase in number of different bacteria present. ROS are related to PMN action in the destruction of periodontal pathogens. A large number of distinct types of bacteria with different pathogenicity increase periodontal

inflammation. It is reasonable that PMNs act upon this inflammation, increasing ROS levels to kill different pathogens. This rise of ROS levels by PMNs would lead to tissue degeneration and hence worsens the status of periodontal disease.

CONCLUSIONS

The results of the present study suggest that a there is significant difference in the MDA and SOD levels of periodontitis patients in their serum .

Malondialdehyde level is commonly known as a marker of oxidative stress and the antioxidant status in cancerous patients and function of SOD is to remove damaging ROS from the cellular environment by catalyzing the dismutation of superoxide radicals to H_2O_2

The main cause of periodontal disease and elevated antioxidant capacity is caused by smoking, diabetes mellitus and inappropriate nutrition. In this study we can conclude that periodontal disease can be evaluated by assessing the oxidative stress markers. In recent years, more attention has been focused on the role of reactive oxygen species, lipid peroxidation products and antioxidant systems in the pathology of periodontitis. Recent medical and dental research in this area are geared towards the prevention of free radical-mediated diseases by using specific nutrient antioxidants [21].

However, further studies are needed to confirm whether oxidant status is a cause of periodontitis which might be targeted to the therapy of periodontitis.

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