CORRELATION BETWEEN SALIVARY MICRONUTRIENT LEVELS IN CHRONIC PERIODONTITIS PATIENTS BEFORE AND AFTER NON-SURGICAL PERIODONTAL THERAPY

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Abstract

Background: A variety of significant macro- and micro- nutrient deficiencies may hinder the progression of periodontal diseases. This study aims to assess the correlation between salivary micronutrient levels in chronic periodontitis patients before and after non-surgical periodontal therapy.
Materials and Methods: A total of 50 chronic periodontitis patients who reported to the Department of Periodontics, Saveetha Dental College and Hospitals, Chennai were enrolled. Levels of Zinc [Zn], Copper [Cu], Iron [Fe], and Selenium [Se] were measured from unstimulated saliva samples before and after scaling and root planing. Paired t-test was done and the results were considered to be statistically significant when the p-value was <0.05.
Results: At baseline (before SRP), the levels of Zn, Cu, Fe and Se were 3.05± 0.53, 8.45± 0.73, 7.30± 2.21 and 2.2± 1.23 respectively. At 3 weeks follow-up (after SRP), the levels of Zn, Cu, Fe and Se were 4.95± 0.48, 5.95± 0.48, 5.74± 0.34 and 4.8± 1.01 respectively. The difference between levels of Zn, Cu, Fe and Se before and after non-surgical periodontal therapy was statistically significant with $p < 0.05$.
Conclusion: The salivary levels of Zn and Se were increased and levels of Cu and Fe were decreased in chronic periodontitis after non-surgical periodontal therapy. This indicates that the levels of micronutrients can be used as effective biomarkers for chronic periodontitis.

Keywords: Periodontitis, Nutritional deficiency, Oral hygiene, Micronutrients

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1. Introduction

The term "periodontitis" describes an inflammatory disease caused by the plaque biofilm that eventually results in tooth loss by causing a loss of periodontal attachment to the root surface and surrounding alveolar bone (1). If it is left untreated, it leads to the destruction of both soft tissues and hard tissues resulting in increased pocket depth, clinical attachment loss, recession, mobility, bone loss, pathologic migration of the teeth and tooth loss(1). Even though plaque is the primary etiology, the disease is aggravated by a variety of risk factors including age, systemic diseases, gender, genetic factors, smoking, stress, hormones(2).

The periodontium is supported in part by nutrition. Nutrients can be categorized as major or minor depending on the amount we consume in our diet. The primary nutrients that are consumed in grams are protein, carbohydrates, and lipids. Micronutrient requirements range from milligrams to micrograms, containing vitamins and minerals. Nutrition mostly affects the course of periodontal disease, even if dietary components play a substantial role in the etiology of dental caries. A periodontal lesion is essentially a wound, and for it to heal properly, the host needs to have appropriate nutrients. According to research, a variety of significant macro- and micro-nutrient deficiencies may hinder the progression of periodontal disorders (7,8).

Micronutrients like copper, zinc, iron, and selenium are crucial for immunological control, anti-inflammatory defense, and immune system modulation(3,4). One of the essential trace elements, copper (Cu), plays a crucial part in the operation of the cytochrome oxidase enzyme at the end of the mitochondrial electron transport chain. The lack of this function, particularly in metabolically active pancreatic acinar cells, enterocytes, and hepatocytes, can contribute to the characteristic swelling and distortion of mitochondria that can be seen in Cu insufficiency (10). Patients with periodontitis have higher serum Cu levels, which can change how the body processes collagen. The normal growth of connective tissue depends on Cu, and the increase in serum Cu may be a result of alterations in the metabolism of periodontal collagen(5,6).

Zinc (Zn) is a crucial trace element that is necessary for the development of numerous internal organs, for maintaining the integrity of cell membranes, and for controlling the activity of insulin and bound enzymes (12). Zn is stored in liver cells by attaching to cytosolic proteins. It also builds up in the mitochondria, where it significantly boosts succinate dehydrogenase activity. Zn is absorbed by the liver, where it binds to subcellular organelles and has an impact on cellular metabolism (13). Our team has extensive knowledge and research experience that has translate into high quality publications (7–16))

By way of enzymatic catalytic processes, iron (Fe), which is a potent pro-oxidant in its free form, causes an increase in the production of free radicals and oxidative stress in the body. As a result, metallic iron is the cause of and a key factor in the development of oxidative damage in periodontitis. Inflammatory responses in periodontal tissues advance as a result of accumulated reactive oxygen species(17,18). Antioxidant activities of selenium (Se) are mostly responsible for its favorable effects on the periodontium. Studies conducted showed that Se stimulated the fibroblasts in the gingival and periodontal ligaments to produce more basic fibroblast growth factor and type I collagen(19,20).

It is still unclear how precisely dietary deficits can contribute to periodontal disease or whether periodontitis can disturb the homeostasis of certain micronutrients. Therefore, it is important to comprehend how micronutrients contribute to the development of periodontal disease and whether they can act as early warning signs of the condition (16). In order to better understand their relationship with periodontal disease, the current study examined the salivary levels of micronutrients (Zinc [Zn], Copper [Cu], Iron [Fe], and Selenium [Se]) in patients with chronic periodontitis before and after non-surgical periodontal therapy.

2. Materials and Methods

Patient Selection

The present study was conducted in the Department of Periodontics, Saveetha Dental College and Hospitals, Chennai. 50 patients who were clinically diagnosed with chronic periodontitis between September 2022 and October 2022 were enrolled. Subjects with probing pocket depth 0f 4-5mm and systemically healthy were enrolled. Pregnant or lactating women, smokers, systemically compromised and immunocompromised and patients on long-term medications were excluded. Ethical clearance was obtained from the Institutional Ethical Committee and written consent was obtained from all the study participants.

Clinical Examination

5 ml of unstimulated saliva sample was collected from all the participants. The sample was centrifuged for 15 minutes at 3000 rpm. Scaling and root planing (SRP) was done for all the study participants.

According to the manufacturer's instructions, the estimation of micronutrient levels was carried out using conventional techniques. Levels of Zinc [Zn], Copper [Cu], Iron [Fe], and Selenium [Se] were measured before scaling and root planing (baseline) and after 3 weeks.

Statistical Analysis

The data was analyzed using Statistical Package for Social Sciences (SPSS Software, Version 23.0). Inferential statistics were done for data summarization and presentation. Paired t-test was done and the results were considered to be statistically significant when the p-value was <0.05.

3. Results

A total of 50 chronic periodontitis patients were recruited for the study. Patients were checked for their levels of Zinc [Zn], Copper [Cu], Iron [Fe], and Selenium [Se] in saliva before scaling and root planing and after 3 weeks of scaling and root planing. At baseline (before SRP), the levels of Zn, Cu, Fe and Se were 3.05± 0.53, 8.45± 0.73, 7.30± 2.21 and 2.2± 1.23 respectively. At 3 weeks follow-up (after SRP), the levels of Zn, Cu, Fe and Se were 4.95± 0.48, 5.95± 0.48, 5.74± 0.34 and 4.8± 1.01 respectively. The difference between levels of Zn, Cu, Fe and Se before and after non-surgical periodontal therapy was statistically significant with $p < 0.05$ (Table 1).

Table 1: Within group comparison of micronutrient levels before and after non-surgical periodontal therapy

MICRONUTRIENTS	**BEFORE SRP (Mean ± Standard deviation) mg/dl**	**AFTER SRP (Mean ± Standard deviation) mg/dl**	**p value**
ZINC	3.05± 0.53	4.95± 0.48	< 0.05
COPPER	8.45± 0.73	5.95± 0.48	< 0.05
IRON	7.30± 2.21	5.74± 0.34	< 0.05
SELENIUM	2.2± 1.23	4.8± 1.01	<0.05

4. Discussion

The present study was done to examine the salivary levels of micronutrients (Zinc [Zn], Copper [Cu], Iron [Fe], and Selenium [Se]) in patients with chronic periodontitis before and after non-surgical periodontal therapy.

Previous studies stated that micronutrients like Zn, Cu, and Mg are crucial for maintaining a healthy immune system and fighting oxidative stress. When malnourished people are exposed to infections, the host reacts by mounting the proper specific and nonspecific immune responses in addition to starting a well-known set of metabolic changes. The availability of an appropriate source of important nutrients to the host determines the viability of the periodontal tissues in both health and illness. The fluctuation and concentration of plasma micronutrients may contribute to periodontitis.

Grace US et al., stated that the trace elements zinc, copper, selenium, and iron play a crucial part in antioxidant enzyme systems. These micronutrients are crucial for the body's numerous regeneration processes, for preventing the negative consequences of oxidative stress, and for maintaining a healthy immune system. Different disorders can be brought on by a lack, imbalance, or excess of these micronutrients. The micronutrients zinc, copper,

selenium, and iron are crucial to the host-microbe interaction because of their impact on immune system function (27). Anand N et al., proved in their study that mean serum zinc levels in periodontitis patients were considerably lower than those in the control group, while those in the DM Type II group were the lowest. This was consistent with research by previous researchers that persons with diabetes had considerably lower mean zinc values than non-diabetics. Additionally, studies have shown that a zinc shortage in gingiva increases the gingival epithelium's permeability to microorganisms and that there is an inverse relationship between zinc levels and loss of alveolar bone (28).

Thomas B et al., revealed that patients with periodontitis had higher serum copper levels and that both immune response and antioxidant state can be modulated by copper (29). Increased serum copper levels have been demonstrated to decrease the formation of antigen-specific antibodies, lymphocyte proliferation, neutrophil counts, and other immune response components in studies using animal models. Additionally, it has been suggested that increased serum copper levels affect collagen metabolism, which in turn can encourage periodontitis (30). The development and progression of oxidative stress, impaired immunity, and changed insulin secretion or action may all be facilitated by excessive levels of copper and iron in serum (31).

According to Hasan RS et al., elevated levels of copper, iron, and zinc can contribute to the development of inflammatory reactions. Therefore, a low intake of zinc may result in a person's immune system being repressed, increased oxidative stress, and a poor capacity for regeneration, all of which raise their risk of developing periodontitis. The micronutrient levels in the saliva of patients with chronic periodontitis were compared with before and after non-surgical periodontal therapy. The results were obtained by comparing the baseline parameters, and micronutrient zinc levels were significantly lower in the test group than in the control group and significantly higher in the treated group (32).

Our results are in accordance with the previous studies. Many physiologic and biochemical reactions depend on trace elements to function. Many of them are metals, and it is unclear and controversial exactly how they contribute to the pathophysiology of periodontal disease. The diagnosis of nutritional and clinical trace element deficiency is one of the most challenging undertakings. It may just take a professional evaluation and a few small dietary changes to reach the ideal levels of periodontal health. It is requisite to do more controlled clinical studies to clarify their precise function in chronic periodontitis.

5. Conclusion

The present study revealed that the salivary levels of Zn and Se were increased and levels of Cu and Fe were decreased in chronic periodontitis after non-surgical periodontal therapy. This indicates that the levels of micronutrients can be used as effective biomarkers for chronic periodontitis.

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Conflicts of Interest
The authors declare that there were no conflicts of interest in the present study.

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