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Assessment of the Effectiveness of Scaling and Root Planning on Fasting Blood Sugar Levels and lipid peroxidation in diabetes patients with chronic periodontitis under systemic administration of nishamalaki- an ayurvedic hypoglycemic formulation

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Abstract

The etiology of diabetes mellitus and periodontitis has both been linked to oxidative stress, which acts as a mediator between these diseases. Glycemic levels and oxidative state are impacted by non-surgical periodontal treatment.The goal of the study was to assess the effectiveness of scaling and root planning on malondialdehyde GCF levels and fasting blood sugar levels in Type II diabetes patients with chronic periodontitis who were receiving Nishamalaki systemically.The study sample consists of ninety recently identified type II diabetes mellitus with chronic periodontitis. After assessing the baseline plaque score, probing pocket depth (PPD) and clinical attachment loss (CAL), fasting blood sugar (FBS) and GCF Malondialdehyde (MDA) levels, the patients were divided in group A and group B. Participants in both groups were administered 2 grams Nishamalaki twice daily for 3 months and scaling and root planing was done in group B patients only. All the periodontal and biochemical parameters were assessed at 1st, 2nd and 3rd months following interventions.There was a statistically significant reduction in plaque score, PPD, CAL, FBS and GCF MDA levels in group B patients in comparison to patients in group A.Non-surgical therapy along with the systemic administration of herbal drug, having both the antidiabetic and antioxidant property, improved the glycemic and oxidative levels in diabetic patients with chronic periodontitis.

keywords: Chronic periodontitis, Diabetes mellitus, Malondialdehyde, Oxidative stress

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1. Introduction

One of the most common diseases, periodontitis is characterized by the breakdown of dental bone and connective tissue, which can lead to tooth loss. This occurs after an inflammatory host response brought on by a periodontal bacterial infection [1]. Gram-negative anaerobic bacteria located in the subgingival region are linked to the breakdown of the periodontium. While the bacterial infection initiates the damaging process, the risk factors that are present and the host's immunological response to the bacterial challenge are what cause the molecular mechanisms that result in the destruction of periodontal tissue [2]. Chronic disorders like diabetes mellitus and chronic periodontitis have long been thought to be biologically connected. Actually, one of the main risk factors for periodontitis is diabetes [3,4].Diabetes may have an impact on the periodontium through a variety of different mechanisms. The idea that treating periodontal infections could improve glycemic control in either type 1 or type 2 diabetes and that periodontal illnesses can lead to poorer glycemic control in patients with diabetes is supported by evidence [5]. Studies have shown that non-surgical

periodontal therapy improves metabolic management in type 2 diabetic patients [6]. A deficient natural antioxidant level was found in periodontal diseases and diabetes mellitus. Oxidative stress is widely established to have a significant role in the etiology of many diseases [7]. By shifting the balance of cellular oxidation-reduction reactions in favor of oxidation, which results in cell damage and the creation of molecules that serve as markers of oxidative stress, Helmut Sies defines oxidative stress [8].The peroxidation of polyunsaturated fatty acids in the plasma membrane caused by reactive oxidative species results in the formation of a carbon-centered radical and the impairment of membrane activities. The pro-oxidant condition is indicated by the presence of lipid peroxidation and the subsequent breakdown products, such as malondialdehyde, in biological fluids [9]. The most well-known particular thiobarbituric reactive compound is malondialdehyde. They have been linked to a variety of pathogenic processes.Since all of the diabetic medications that are now on the market have one or more side effects, managing diabetes without any side effects is still a difficult task for medical professionals. In the management of diabetes mellitus, it has been suggested that simultaneous treatment of hyperglycemia and oxidative stress may be more efficient than rigorous treatment of hyperglycemia alone.Due to their efficiency, lack of negative side effects, and affordable price, herbal medications are frequently given. Curcuma longa (turmeric) and Amla (Indian gooseberry) are combined in a 1:1 ratio to create the distinctive ayurvedic concoction known as Nishamalaki (NA) [10]. Studies have demonstrated that amla prevents glucose from being absorbed and postpones its arrival into the circulation. Among the various properties of curcuma longa that have been scientifically investigated are its antioxidant, anticancer, antiinflammatory, antidiabetic, lipid-lowering, and wound-healing properties [11]. Studies have shown that the curcumin in turmeric enhances the pancreatic β-cells' functionality [12].

The goal of the current study was to evaluate the impact of scaling and root planing on malondialdehyde GCF levels and fasting blood sugar levels in Type II diabetic patients with chronic periodontitis who were receiving Nishamalaki systemically.

2. Materials and Methods

The research procedure was agreed by the Institutional Human Ethical Committeebefore the initiation of the study. Patients reporting to the Ayurvedic hospital for the treatment of diabetic, were subsequently subjected to fasting blood sugar, following informing the patients about the study protocols to assess the glycemic status of diabetic. Ninety newly diagnosed type II diabetes mellitus,in the age group of 30 -50 yearswith FBS value ≥ 126 mg/dlwith chronic periodontitis, wereselected.Female subjects, patients with other forms of systemic illness (other than Type 2 diabetes mellitus), subjects who have done any form of periodontal treatment six months prior to the initiation of the study and subjects with any adverse habits, drugs or systemic factors that wouldinfluence with the outcome of the study were excluded.The following parameters were evaluated: baseline plaque index, probing pocket depth, clinical attachment level, FBS, and GCF malondialdehyde levels. The patients were divided into Group A and Group B at random after determining the baseline clinical and biochemical characteristics. All the patients in both the groups were prescribed Nishamalaki 2 grams twice daily for 3 months by Ayurvedic physician and scaling and root planning was done only for group B patients.Patients were recalled for review and all the parameters were reassessed at the end of 1st, 2nd and 3rd month following interventions.Statistical investigation was done using SPSS Version 23 Software, IBM Statistics. Baseline parameters were compared using independent t-test. and R-ANOVA (Repeated Analysis of Variance) followed by multiple comparison using Bonferroni Test: was used to assess the effectiveness of drug in group A and adjunctive use of scaling and root planing along with the drug in group B in terms of changes in clinical and biochemical parameters.

2.1. Collection of samples

Brill's technique was used to collect gingival crevicular fluid. With care taken to avoid salivary contamination, the area was sealed off with cotton rolls, and it was then gently air dried. By using standardisedPeriopaper, the GCF samples were collected from locations with the deepest probing pockets. The strips were carefully placed into the areas with the most pockets until a minor resistance was felt, and then held in place for 30 seconds to absorb all the moisture in the crevice without causing any discomfort. Each patient provided a volume of pooled GCF samples ranging between 15 and 20 l. The GCF samples that were thus obtained were combined into Eppendorf tubes that contained 200 l of 20 mM Tris HCl buffer (PH 6.5) and were kept at 80°C until malondialdehyde analysis was performed on them.

2.2. Lipid peroxidation (MDA) assay

A commercially available kit (MAK085D; Sigma, St. Louis, MO) was used to measure the amounts of malondialdehyde using the Lipid Peroxidation Assay, which is based on the condensation reaction between malondialdehyde and thiobarbituric acid (TBA).25 ml of TBA solution is created by reconstituting a bottle of TBA with 7.5 ml of glacial acetic acid and ddH2O.The mixture was then combined with 20 l of GCF and 500 l of 42 mM sulfuric acid, added 125 l of PTA, and vortexed. Next, the solution was diluted with 10 l of 4.17 M MDA standard in 407 l of ddH2O to create 0.1 M MDA standard. The mixture was centrifuged at 13,000 g for 5 minutes at room temperature, and the serum pellet was recovered and re-suspended in 102 l of BHT/ddH2O on ice. The final volume was then adjusted to 200 l using ddH2O, and vortexing was done after that. The solution was incubated at 95 °C for 1 hour, followed by 15 minutes of cooling in an ice bath. Using the serial dilutions of the MDA standard to create the standard curve and determine the MDA concentrations

Table 1: Intra-group comparison of clinical parameters in Group A at Various Periods of Study

	Plaque Score	PPD	CAL	p-value
Baseline	2.59	5.00	2.59	< 0.001
1st Month	2.62	5.11	2.62	
2nd Month	2.62	5.51	2.62	
3rd Month	2.62	5.92	2.62	

Table 2: Intra-group comparison of clinical parameters in Group B at Various Periods of Study

	Plaque Score	PPD	CAL	p-value
Baseline	2.61	5.04	2.61	< 0.001
1st Month	2.09	4.97	2.09	
2nd Month	1.48	4.00	1.48	
3rd Month	0.97	3.40	0.97	

Table 3: Intra group comparison of FBS and MDA levels in Group A at Various Periods of Study

	FBS	MDA	p-value
Baseline	132.82	1.17	< 0.001
1st Month	131.11	1.15	
2nd Month	128.71	1.15	
3rd Month	127.11	1.16	

Table 4. Intra-group comparison of FBS and MDA levels in Group B at Various Periods of Study

	FBS	MDA	p-value
Baseline	132.66	1.19	< 0.001
1st Month	129.60	1.13	
2nd Month	126.22	1.05	
3rd Month	118.55	0.37	

3. Results and discussions

At the end of the third month, all the parameters were shown to have significantly decreased in the group B patients as compared to the group A, with a statistically significant p 0.05 (Table 1& Table 2).

3.1. Biochemical Findings

At the end of 3rd month, the FBS values and MDA levels were improved in group B patients as compared to group A patients. (Tables 3 & 4). According to published research, diabetes mellitus and periodontitis are inversely correlated, with diabetes increasing the risk of periodontitis and periodontitis potentially impairing glycemic control in vulnerable individuals [13, 14]. Through an overactive innate immunity and an increased host immunological inflammatory response, oxidative stress is a common component in both periodontal disease and diabetes mellitus. These two diseases can interact with one another to cause a larger redox control imbalance in the body when they coexist [15, 16].In the current study there was an improvement in all the periodontal clinical parameters at the end of 3rd month in group B patients, where Nishamalaki drug and SRP was done as compared to group A, where only the drug was administered. Buzininet al [17] and Sinha et al. [18] in their studies also found similar results, where an improvement in all the clinical parameters, including plaque score, PPD, and CAL following nonsurgical periodontal therapy in type-2 diabetic patients with generalized chronic periodontitis.In the present drug, Nishamalaki an antidiabetic drug was administered to all the patients in both the groups studied and a considerable decrease in the glycemic values was found in both the groups, but the FBS values were more improved in group B patients, where non-surgical periodontal therapy was also done along with the antidiabetic drug.Clinical studies [19, 20]. have demonstrated that periodontitis and its management may affect glycemic control. The local signs and symptoms of the illness are lessened with effective therapy of periodontal infection [21, 22]. Bedarkar et al,[21] in their study also found a considerable decrease in fasting and postprandial blood sugar levels in the Nishamalaki drug-treated group along with reduction in signs and symptoms of the disease. Kashinath et al[23] also found similar results, where drug Nishamalaki was administered to diabetic patients and found 8.6% and 15.7% reduction in FBS after 1 and 2 months, respectively. This investigation supported the notion that the successful management of periodontitis in conjunction with systemic administration of an antidiabetic medication as an additional therapy can enhance metabolic control. A considerable decrease in FBS levels was attained in addition to the periodontal improvement.According to some research, those who have periodontal disease are more vulnerable to an antioxidant-oxidative stress condition [23]. Since ROS have a relatively brief lifespan, they are difficult to find. However, the end product of LPO, such as MDA [24], which is the most important and extensively researched product of polyunsaturated fatty acid peroxidation, can be used to evaluate ROS-related tissue deterioration.In the current study GCF malonaldehyde levels showed a significant reduction from baseline to 3 months post treatment in both the groups of patients, which was more pronounced in group B patients, who underwent SRP along with Nishamalaki administration.Similar to our study, Wei et al [25] and Chapple et al [26] found that MDA levels in GCF showed a significant reduction after non-surgical periodontal therapy.The large drops in MDA following scaling indicate that effective nonsurgical treatment appeared to have restored the local total antioxidant capacity in CP.In the present study reduction in MDA levels in GCF levels post treatment in group B patients could be partly due to a reduction of lipid peroxidation in the periodontium resulting from reduced amounts of bacteria and their products after scaling and root planing. The significant decrease in MDA levels after therapy suggested that local total antioxidant capacity seems to be restored by successful non- surgical therapy [27].The periodontal clinical parameters and FBS and MDA levels were significant at baseline which indicates that the treatment outcome was highly influenced by the baseline values.Thus, in the current study significant improvements were seen with both the groups, but SRP along with the Nishamalaki provided profound changes in all clinical and biochemical parameters than subjects treated with the antidiabetic drug alone.

4. Conclusions

This study confirms the current belief and advances our knowledge of how oxidative stress persists in patients with type II diabetes mellitus as well as those with chronic periodontal disease. Moreover, adjunctive scaling and root planning along with Nishamalaki drug, having both antidiabetic and antioxidant properties improves the periodontal and metabolic parameters when compared to drug alone. These findings can potentially serve as a springboard for further investigation into the effectiveness of various antioxidants in preventing and treating periodontal disease in diabetes patients.

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