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Effect of Non-Surgical Periodontal Therapy on Salivary Glucose Levels in Chronic Periodontitis Patients with Type 2 Diabetes: A Pilot Study

Kristi Ananya Deka, Gayathri. K, P. L. Ravishankar and Sai Sri Soury. G

Department of Periodontology, SRM Kattankulathur Dental College and hospital, SRM Institute of science and technology, SRM Nagar, Kattankulathur 603203, Chengalpattu, Tamil Nadu, India.

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To assess whether nonsurgical periodontal therapy lowers salivary glucose levels in diabetic patients and healthy individuals with chronic periodontitis patients. 20 individuals with and without type 2 diabetes with widespread periodontitis were involved in this study. Subjects were designated into two groups based on their systemic status. Group I consisted of ten systemically healthy periodontitis patients. Group II consisted of ten diabetic patients with periodontitis. Glucose levels in saliva along with the periodontal parameters were recorded in all the subjects preoperatively at baseline and 3months after periodontal therapy. At baseline, when the clinical parameters were compared among the groups, no statistically discernible difference was found. At baseline, mean salivary glucose levels in group 1 and group 2 were 0.76±0.34mg/dl and 6.02±2.55mg/dl respectively. At 3 months post-operatively, mean salivary glucose levels in group 1 and group 2 were 0.67±.0.30 mg/dl and 5.71±2.27mg/dl.At 3-months follow-up, clinical parameters and salivary glucose reduced in both groups. The considerable reduction in salivary glucose levels following therapy raises the possibility that it could be used as a target inflammatory marker in periodontal diseases. Keywords: Chronic periodontitis, Non-surgical periodontal therapy, salivary glucose, Type2 diabetes mellitus

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Diabetes and periodontal disease are inflammatory diseases that possess a two-way interaction. Periodontal disease was ranked as the sixth diabetes consequence by Löe in 1993. Production of pro-inflammatory mediators in periodontitis can lead to insulin resistance and change how lipids and glucose are metabolized. As a result, periodontal disease can impair diabetics' ability to control the blood sugar[1].

Compared with individuals with a healthy periodontal condition, diabetics have two to three times higher chance of acquiring periodontitis, and one of the most important indicators of risk is the level of glycemic control. In diabetic patients, having periodontitis is associated to an elevated higher HbA1c levels and may further worsen diabetes complications due to increase in the inflammatory burden[2]. Thus the association between periodontitis and diabetes shows a link between systemic illness and oral infection.

Over the past two to three decades, numerous studies have looked into how periodontal

*Corresponding author E-mail: kd9341@srmist.edu.in

therapy affects diabetic patients' ability to control their blood sugar levels. In general, these research' findings have consistently shown that periodontal therapy lowers blood glucose and HbA1c levels.[3] Currently, there are three main methods for diagnosing diabetes: the random blood sugar test (RBS), the glucose tolerance test (GTT), and the glycated hemoglobin (HbA1c) test. Diabetes is confirmed by an HbA1c of 6%, and the severity of the score is correlated with diabetic complications.[4]

A far easier and non-invasive method for diabetes diagnosis and monitoring is advisable because regular blood glucose testing creates unneeded discomfort and mental trauma for patients. Recently, there has been a rise in interest in using saliva as a diagnostic fluid since it can be collected non-invasively, with less training and technique sensitivity.[5] Since collecting saliva is associated with fewer compliance issues than collecting blood, its more reliable to use saliva as a potent diagnostic tool. [6]

Due to the small size and ease of diffusion via semi permeable membranes, glucose can be found in saliva, especially when blood sugar levels are high. Norma salivary glucose levels range from Previous study has reported elevated salivary glucose levels in diabetics[7]. However, no prior research have compared salivary glucose levels in type 2 diabetes mellitus (T2DM) who had chronic periodontitis before and after non- surgical periodontal therapy. The glucose concentration was measured in the current study using saliva, making self-measurement of glucose a non-invasive process. Hence, the purpose of this pilot study was to evaluate whether nonsurgical periodontal treatment (NSPT) lowers salivary glucose levels in type 2 diabetics with periodontitis.

MATERIALS AND METHODS

This pilot study was carried out in Department of Periodontology, SRM Kattankulathur Dental College & Hospital, Potheri, Tamil Nadu, India. The current study was approved by institutional ethical board. This pilot study included 20 generalized chronic periodontitis patients (13 males and 7 females) with and without T2DM.. The selected subjects were categorized into 2 groups, Group I consisted 10 patients (8 males and 2 females) with persistent periodontitis who were in overall good health and Group 2 contained 10 patients (5 males and 5 females **)**with type 2 diabetes and chronic periodontitis. In group 2 the participants with T2DM with average blood glucose level of 130-200 mg/dl were included

In both groups generalized chronic periodontitis patients within age group 30-60 years, with presence of minimum of e"10 teeth per dental arch, exhibiting pocket depth e"5 mm with CAL of e"3 mm with > 30% sites involved (AAP 1999) were included in the study. In group 2 Patients exhibiting random blood glucose concentration within range of 130-200mg/dl were also included.

Pregnant women, people with systemic diseases that could affect the course of periodontal disease in the blood, people who had taken anti-inflammatory medicines for 4 weeks before to the trial, smokers or had quit smoking within the last 5 years, and those with these conditions were excluded from the study. The entire study procedure was elaborated to the selected patients and their consent was obtained in written format.

Periodontal parameters including plaque index (PI), gingival index (GI), probing pocket depth (PPD) were recorded and documented before the periodontal therapy. Nonsurgical periodontal therapy that comprises of scaling and root planing (SRP) was performed in all patients. Oral hygiene instructions were reinforced for all the patients as home care regimen (brushing technique and interdental cleaning) following SRP. All patients were re-evaluated after three months after the initial examination, and clinical parameters were assessed and compared with the baseline values.

Salivary glucose analysis**:** Evaluation of salivary glucose level in the saliva sample was done before therapy and 3 months. Quantitative evaluation of salivary glucose was performed using a commercially available glucose oxidase-peroxidase assay kit (GOD-POD method)[8] and the values were attained. Individuals were instructed not to have anything for atleast two hours before saliva collection. Between 11:00 am and 12:00 pm, 5 ml of whole, un-stimulated saliva from each individual was collected using the spitting technique. Until the experiment started, saliva was obtained in sterile tubes and immediately frozen at 80°C. Each saliva sample weighed 5 ml and was pipetted into a completely fresh microcap tube and clarified by centrifuging at 10,000 rpm for 1

minute. In order to conduct an analysis, a clean microcap tube was used to quickly transfer the supernatant[9].

Statistical Analysis

Data were analyzed using IBM SPSS version 20 software (IBM SPSS, IBM Corp., Armonk, NY, USA). Independent samples t tests, paired t tests were done to analyze the study data.

RESULTS

Total of 20 participants among were included in the present study. In the current study, the baseline periodontal parameters and salivary glucose levels were recorded at baseline and after SRP since saliva has proven to be good indicator for measuring the glucose levels in the diabetic patients. The observed results were reported as mean ±SD with P-values indicating their level of significance. When the clinical parameters were compared among the groups, no statistically discernible difference was found at baseline however after SRP there was reduction in both periodontal parameters and salivary glucose (Table 1 and Table 2). At baseline, mean salivary glucose levels in group 1 and group 2 were 0.76±0.34mg/dl and 6.02±2.55mg/dl respectively (Table 1). At 3 months postoperatively, mean salivary glucose levels in group 1 and group 2 were 0.67±.0.30 mg/dl and 5.71±2.27mg/dl. In comparison to

Table 1. Comparison of baseline clinical parameters between the study groups A

Variable	Group	N	Mean ± SD	P value
GI	1	10	2.44±0.35	0.587
	2	10	2.35±0.35	
PI	1	10	2.57±0.18	0.11
	2	10	2.43±0.18	
PPD	1	10	4.90±0.48	0.711
	2	10	4.80±0.75	
Salivary Glucose	1	10	0.76±0.34	<0.001*
	2	10	6.02±2.55	

Independent samples t test; p≤0.05 considered statistically significant; * denotes significance

Table 2. Comparison of clinical parameters post SRP between the study groups

Variable	Group	N	Mean ± SD	P value
GI	1	10	1.75±.0.37	0.688
	2	10	1.83±.0.44	
PI	1	10	1.95±.0.29	0.136
	2	10	2.11±.0.17	
PPD	1	10	4.44±.0.51	0.639
	2	10	4.31±.0.66	
Salivary Glucose	1	10	0.67±.0.30	<0.001*
	2	10	5.71±2.27	

Independent samples t test; p≤0.05 considered statistically significant; * denotes significance

Table 3. Intragroup comparison of clinical parameters from baseline to post SRP

Group	Parameter	N	Mean ± SD	Mean diff.	P value
1	GI BL	10	2.44±0.34	0.691	<0.001*
	GI Post	10	1.75±0.36		
	PI BL	10	2.53±0.18	0.623	0.001*
	PI Post	10	1.95±0.28		
	PPD BL	10	4.91±0.47	0.47	<0.001*
	PPD Post	10	4.43±0.50		
	SG BL	10	0.76±0.34	0.09	0.108
	SG Post	10	0.67±0.30		
2	GI BL	10	2.35±0.35	0.53	<0.001*
	GI Post	10	1.82±0.43		
	PI BL	10	2.43±0.18	0.319	<0.001*
	PI Post	10	2.12±0.17		
	PPD BL	10	4.80±0.75	0.49	<0.001*
	PPD Post	10	4.31±0.66		
	SG BL	10	6.02±2.54	0.317	0.046*
	SG Post	10	5.71±2.27		

1.Paired t test; p≤0.05 considered statistically significant; * denotes significance

normal salivary glucose levels (0.5mg/dl-1.0mg/dl)[9] group 2 showed elevated salivary glucose values at baseline (Table 2). After scaling and root planing there was significant reduction (p=<0.001) in salivary glucose levels to 5.71 mg/dl in group 2 at three month follow up (Table 3). Intra-group comparisons revealed significant reduction of periodontal parameters and salivary glucose levels from baseline to post SRP.

DISCUSSION

In the current study, 20 generalized chronic periodontitis (CP) patients presenting with and without T2DM were assessed for salivary glucose levels prior to non-surgical periodontal therapy and after 3 months of periodontal intervention. The relationship between diabetes and periodontal health has receive lot of focus in the dental literature. According to reports, periodontitis is considered as sixth consequence of diabetes. [1] Non-surgical periodontal therapy employed for management of generalized chronic periodontitis has been proved to improve the glycaemic status in T2DM patients. [4] We measured the concentration of salivary glucose and its response to NSPT in this study since there are few studies that assess the concentration of glucose in saliva and because there is disagreement over the association between salivary glucose and glycaemia. In diabetic patients, saliva has been shown to be are liable indication of glucose levels.[10] Although we understand that saliva contains glucose, the mechanism by which it is secreted is still unknown. Despite both paracellular and intercellular pathways have been put forth, this is still just a hypothesis and not a proven theory. According to López et al., salivary glands change their function as blood glucose filters in response to hormonal or neurological regulation.[11] Persistent hyperglycemia changes the salivary glands' basement membrane and causes micro vascular abnormalities in the blood vessels. Due to increased glucose leakage from ductal cells of the salivary glands as a result, the amount of glucose in saliva increases[12]. The non-invasive nature of salivary evaluation and its affordability for mass population screening have benefits. Periodontal parameters like plaque index, gingival index and probing depth were evaluated at baseline and after 3 months post non-surgical periodontal therapy since it takes around 3 months to completely resolve gingival inflammation and improve tissue healing [13].

In the current study, at baseline there is no statistical difference in periodontal parameters between the study groups, since all the study participants exhibited similar periodontal status during the recruitment for the study. However, baseline salivary glucose level was significant between the groups since group 1 consists of systemically healthy patients with CP and group 2 consists of T2DM patients with CP. At 3 months, the study findings revealed statistically significant improvement periodontal parameters in both groups, intergroup comparison of salivary glucose level showed significant difference. These results are in accordance with Vedavalli Subramanian et al. [14]

Intra group comparison of clinical parameter and salivary glucose levels from baseline showed significant reduction post non-surgical periodontal therapy. These results are comparable to those of a meta-analysis by Quanlietal which concluded that nonsurgical periodontal care was helpful in improving glycaemic control in patients with CP and T2 DM.[15] The average concentration of salivary glucose for the T2DM patients in current study was 6.02mg/dl, which is in accordance with results obtained by Di Gioia et al [16] SGL =5.57 mg/dl and Maria Sueli et al [17] SGL =5.94 mg/dl. However, our results were in contrast to the results obtained by Vidyakadashettietal[10] and Sivakumar et al [18.] Periodontal treatment improved clinical measures of chronic periodontitis in patients with diabetes, supporting use of non-surgical periodontal treatment for lowering salivary glucose level[19]. Selection of a particular study design, as well as the variety of techniques and criteria used in collection of samples, may be one explanation for these differences. Also in the current study we selected diabetic patients with average blood glucose level 130-200 mg/dl which might have contributed to lower salivary glucose values when compared to above studies. The finding of this pilot study depicts saliva as a useful diagnostic tool for the early identification of diabetes mellitus. To determine the diagnostic efficacy of salivary glucose level in the early diagnosis of diabetes 2 mellitus randomized control trails with large sample sizes and long term follow up should be done.

CONCLUSION

There are numerous analytes in saliva that can be employed as biomarkers for clinical and translational purposes, including DM. Saliva is easily accessible. Thus, the study shows that salivary glucose be used as a diagnostic parameter to assess glycaemic control in T2DM.

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Conflict of Interest

There are no conflict of interest.

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