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Healing response to non surgical periodontal therapy in patients with diabetes mellitus

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Abstract

Background & AIM: Despite several investigations, evidence is still controversial regarding the effect of periodontal treatment on diabetes. This study evaluates and compares the effect on glycemic control and periodontal status with or without nonsurgical periodontal therapy in patients with type 2 diabetes mellitus and chronic periodontitis.

Materials & Methods: A total of 60 patients diagnosed with diabetes and with moderate to severe periodontitis were selected. They were assigned in an alternative sequence, into test and control group. Both groups were instructed to continue with their medical treatment without modifications. Scaling and root surface debridement were performed in the test group whereas the control group received oral hygiene instructions with no treatment during the 3-month study period.

Result: Reductions in all the clinical parameters were observed and were found to be statistically significant ($P < 0.005$). Karl-Pearson coefficient test, Z-test, and paired *t*-test

Conclusion: This study showed that nonsurgical periodontal therapy may have a beneficial effect on HbA1c level in moderately controlled type 2 diabetic patients.

Keywords: non surgical periodontal therapy, diabetes mellitus

Introduction

Periodontitis is a bacterial infection associated with Gram negative anaerobes. Diabetes mellitus (DM) is a clinically and genetically heterogeneous group of metabolic disorders manifested by abnormally high levels of glucose in the blood due to a deficiency of insulin secretion or resistance to insulin action. In the recent years, there has been an emerging interest in the link between the periodontitis and systemic conditions [1]. The effects of long-standing IDDM and NIDDM, and of poor metabolic control are pathological changes, such as microvascular and neurological changes, impairment of collagen synthesis and diminished function of polymorphonuclear granulocytes (PMN) [2, 3]. Long standing hyper glycemia causes thickening of vascular basement membranes, which reduces tissue nutrition and migration of leukocytes [2]. PMNs play an important role in the protection of periodontal tissues against periopathogenic bacteria and in periodontal wound healing [4]. This alteration of tissue structure & host immune response might cause an increased risk for infections and an impairment of wound healing in diabetic patients [5]. The complex pathogenesis of this disease is further complicated by the coexistence of systemic diseases, such as diabetes, which has the potential to aggravate the manifestations of periodontitis. Periodontal disease and diabetes mellitus belong to a pathologic condition in which both diseases could negatively interfere with each other, constituting a bidirectional relationship with diabetes increasing the risk for periodontitis and periodontal inflammation negatively affecting glycemic control and the progression of vascular complications [6].

Materials and Methods

The present study was conducted in Lenis Dental Clinic, New Delhi. The ethical clearance was taken from ethical committee.

Sample Size: Sample size was calculated based on expected mean difference in the reduction of HbA1c in diabetic group of around 0.9–1.0%; it was calculated that at least 15 patients would be needed to detect this difference with 80% power and two sided type 1 error of 5%.

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The basic formula used was

$$m = 2 \times [(1-\alpha/2) + Z(1-\beta)]^2 \div \pi$$

$(1-\alpha/2)$ = significance level,

$Z(1-\beta)$ = power,

π = standard difference effective size

Based on the abovementioned values, it was found that 30 patients per group were necessary to provide 80% power at 95% CI ($\alpha=0.05$).

Inclusion Criteria

Inclusion criteria for both the groups in the study were as follows:

1. Age 35–70 years;
2. Type 2 DM with HbA1c values of 6%–8%;
3. Medically stable ambulatory patients;
4. diagnosis of moderate to severe generalized chronic periodontitis for both the groups, with at least one tooth having a true probing depth (PD) of ≥ 5 –7 mm in each quadrant (either anterior or posterior); and
5. presence of >16 teeth in the mouth, excluding third molars

Exclusion Criteria

- 1) Presence of systemic diseases (other than DM and hypertension with no change in their medications; participants taking calcium channel blockers were excluded);
- 2) smoking or alcoholism;
- 3) diabetic complications;
- 4) intake of systemic antibiotics in the last 3 months;
- 5) periodontal treatment 3 months prior to the study;
- 6) pregnant adults; and
- 7) Failure to give an informed consent.

Procedure

The clinical and biochemical parameters were recorded at the baseline (day 0) and 3 months after the periodontal therapy. To minimize the interexaminer and intraexaminer variability, calibration and standardization of the examiner were done. This was evaluated and calculated statistically till more than 90% similarity in their observations was achieved. The participants were instructed to continue with their medical management of DM without any modification during the study period.

Plaque index (PI) (Silness P and Loe H 1967)

Gingival index (GI) (Loe H and Silness J 1963)

Sulcus bleeding index (SBI) (Muhlemann HR and Son S 1971)

Probing pocket depth (PPD) — the recordings were done on all the four sites (buccal, lingual, mesial, and distal) of each tooth. It was measured from the gingival margin to the base of the pocket using University of North Carolina (UNC)-15 probe.

Clinical attachment level (CAL) — the recordings were done on all the four sites (buccal, lingual, mesial, and distal) of each tooth. It was measured from the cemento-enamel junction (CEJ) to the base of the pocket using UNC-15 probe.

For the metabolic assessment, 3–4 mL of venous blood sample was withdrawn and analyzed for:

1. Fasting blood glucose.
2. Postprandial blood glucose.
3. HbA1c.

Results

There were 30 type 2 diabetic patients with moderate to severe periodontitis in the study sample. As regards the associated disease in this study, systemic hypertension was present in 17 (52.47%) patients in the test group and 20 (63.78%) in the control group ($p=0.505$).

Groups at baseline

There was no significant difference between GI ($p=0.143$) and CAL ($p=0.130$) between the groups at baseline. There was a slight increase in PD ($p=0.006$) of the test group compared to that of the control group. The HbA1c levels of both the groups were similar ($p=0.637$).

Comparison of periodontal parameters at 3 months

In the test group, GI scores dropped from 1.4 ± 0.34 to 1.2 ± 0.33 , which was statistically significant ($p < 0.001$), whereas in the control group, an insignificant increase was observed from 1.65 ± 0.33 to 1.69 ± 0.31 ($p=0.100$). Similarly, in the test group, PD and CAL decreased from 5.65 ± 0.91 mm ($p < 0.001$) and from 5.23 ± 0.89 to 4.93 ± 1.12 mm ($p < 0.001$), respectively, which was statistically significant. In the control group, a statistically insignificant increase was observed for PD and CAL from 5.34 ± 0.84 to 5.39 ± 0.90 mm ($p=0.258$) and from 5.66 ± 1.06 to 5.71 ± 1.07 mm ($p=0.103$), respectively. Significant changes were observed in GI, PD, and CAL ($p < 0.01$, $p < 0.001$, and $p < 0.001$, respectively) in the test group compared to the control group.

Comparison of metabolic parameters at 3 months

In the test group, there was a reduction of 1.4% (1.63 ± 6.95) in the HbA1c level. The values decreased from $5.54 \pm 0.50\%$ to $5.35 \pm 0.61\%$, but the values were statistically insignificant ($p=0.078$). The control group showed a minor increase of 0.43% (0.43 ± 3.71) ($p=0.535$). However, a significant improvement in the HbA1c levels (0.06%) was observed in the test group when compared to the control group ($p=0.029$).

Discussion

The intention of the study was to evaluate the effect of non-surgical periodontal therapy on the metabolic control in patients with type 2 DM without any diabetic complications. The results of this study were statistically significant enough to prove the efficiency of nonsurgical periodontal therapy in improving glycemic control by 0.06% at the end of 3 months. The reported results also showed a significant improvement in clinical periodontal parameters in the test group, with the PD reduction by 0.7 mm and gain in CAL by 0.1 mm, whereas in the control group there was a slight increase in PD, and CAL by 0.05 mm.

Many biologically plausible mechanisms have been identified and reviewed to explain the pathobiology of the interactions between diabetes and periodontal disease [7]. In a sustained hyperglycemic state, proteins become irreversibly glycosylated to form advanced glycation end-products (AGEs). AGEs form on collagen, increasing collagen cross-linking, and result in the formation of highly stable collagen macromolecules. These products accumulate in the tissues due to their resistance to normal enzymatic degradation and tissue turnover. They activate a receptor known as “receptor for AGEs” (RAGE), which is found in the periodontium.

HbA1c is one of the most important markers in type 2 diabetic patients and is used to evaluate the severity as well as the glucose control condition. A study done by Demmer *et al.* reported that in nondiabetic patients, periodontitis

anticipates the progression of HbA1c level and its reduction is likely to lower the potential of having the disease which is in support of present study [8].

Seppala and colleagues [9] conducted a two-year study of the periodontal condition of two groups of adults (aged 35 to 56 years) with type 1 diabetes after providing periodontal treatment. One group had poorly controlled type 1 diabetes (n = 26 for one-year follow-up, n = 16 for two-year follow-up) and the other had better-controlled diabetes (n = 12 for one-year follow-up, n = 6 for two-year follow-up). The first of two reports of this study documented improved HbA1c levels in subjects with poorly controlled diabetes and in subjects with well-controlled diabetes during the two-year period, showing a reduction in mean HbA1c from baseline to two-year follow-up of 9.9 percent to 9.6 percent in those with poorly controlled diabetes and 9.5 percent to 7.6 percent in those with well controlled diabetes ($P < .068$). However, a second report stated that the periodontal treatment did not significantly improve the HbA1c or blood glucose levels in the group with poorly controlled diabetes, while still reporting $P < .068$. Unfortunately, it was not possible to resolve the discrepancy in the results from the information provided. The results of this study is in contrary to the present study [10].

In the present study, periodontal inflammation had only a minimal influence on medical data as already described by Thorstensson *et al.* which is in support of study done by Christgau M *et al.* [11]

Conclusion

The data in the current study have been interpreted to suggest that Non-Surgical Periodontal therapy is associated with improvement in the periodontal status simultaneously with the improvement in the glycemic control in persons with type 2 DM. The clinical improvement obtained was accompanied by a significant reduction in HbA1c values in type 2 DM patients, confirming the existing interrelationship between DM and periodontal disease.

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