

White Papers

New Research and Commentary on the Oral-Systemic Relationship*



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Experimental Gingivitis in Type 1 Diabetics: A Controlled Clinical and Microbiological Study

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Abstract

Objective: To monitor clinical and microbiological changes during experimental gingivitis in type 1 diabetics and non-diabetics.

Materials and Methods: Nine type 1 diabetics with good/moderate metabolic control and nine age-gender matched non-diabetics were recruited. Probing pocket depths in all subjects did not exceed 4 mm and none were affected by attachment loss. According to the original model, an experimental 3-week plaque accumulation resulting in experimental gingivitis development and a subsequent 2-week period of optimal plaque control were staged. Subgingival plaque samples were collected at days 0, 21 and 35 from one site per quadrant, pooled and analyzed using checkerboard DNA-DNA hybridization.

Results: Diabetics (mean age 25.6 ± 5.8 standard deviation (SD), range 16-35 years) had a mean HbA_{1c} level of $8.1 \pm 0.7\%$ (SD), while non-diabetics (mean age 24.8 ± 5.7 (SD), range 15-36 years) were metabolically controlled ($HbA_{1c} \leq 6.5\%$). Between days 0, 21 and 35, no statistically significant differences in mean plaque and gingival index scores were observed between diabetics and non-diabetics. At days 7 and 21, however, diabetics showed statistically significantly higher percentages of sites with gingival index scores ≥ 2 compared with non-diabetics. Mean DNA probe counts of the red and orange complex species increased significantly ($p < 0.05$) between days 0 and 21 and decreased significantly ($p < 0.05$) between days 21 and 35 in both groups.

Conclusion: Both diabetics and non-diabetics react to experimental plaque accumulation with gingival inflammation. Type 1 diabetics, however, develop an earlier and higher inflammatory response to a comparable bacterial challenge.

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What does the study teach us?

Type I diabetes mellitus is a systemic autoimmune disease that affects the metabolism of carbohydrates, proteins, and fats. This disease has been associated with several systemic complications such as nephropathy, neuropathy, retinopathy, angiopathy, and wound healing, as well as oral complications, which include periodontal disease. The pathogenesis involved in periodontitis requires a bacterial infection, the formation of a biofilm, and the host response to this infection. The response can be affected by a compromised immune system, leading to an exaggerated immuno-inflammatory response to the bacterial challenge. Both controlled and poorly controlled type I diabetic patients appear to be more susceptible to the initiation of gingival inflammation when there is a persistent bacterial challenge present, and indeed patients with diabetes are prone to develop oral complications, the most prominent of which is an increased prevalence and severity of periodontal disease. The introduction of good oral hygiene practices, however, can shift the bacterial flora toward gram-positive aerobic organisms associated with gingival health.

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This article describes a clinical and microbiological longitudinal study that replicates Løe's experimental gingivitis model with type I diabetic and non-diabetic young adults. The authors matched nine type I diabetic subjects with good to moderate metabolic control with nine healthy, non-diabetic subjects. Both diabetics and non-diabetics showed a significant increase in both the mean Plaque Index (PI) score and Gingival Index (GI) score during the three weeks of cessation of oral hygiene activities. When the two groups

*Most published research to date shows that there is a possible association between periodontitis and systemic health. A causal relationship between the two has not yet been clearly established.

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were compared, the diabetic subjects displayed statistically significant increases in the mean GI scores, even though there were no significant differences in the PI scores between the groups. When the mean percentage of sites with GI scores of 2 or greater was measured to evaluate the severity of inflammation and document bleeding, diabetic patients showed a significantly greater number of bleeding sites with scores of 2 or higher at days 7 and 21 than the non-diabetic subjects. After 21 days, diabetics were 16 times more likely to display a substantial percentage of bleeding sites (greater than 35%) compared with non-diabetics.

This study confirms previous reports that despite similar plaque levels at all time points, type 1 diabetics develop an earlier and heightened inflammatory response compared to the non-diabetics with an equivalent bacterial burden. Previous studies have reported that the presence of gingivitis in subjects with diabetes is not related to higher levels of plaque accumulation because the plaque indices are not usually higher in subjects with diabetes. This translates into a heightened host response to the bacteria that are present, indicating that diabetics are at greater risk for the development of gingivitis and, subsequently, periodontitis. The lead author of this article has previously reported up to a four-fold increase in the level of pro-inflammatory mediators present in the gingival crevicular fluid of subjects with type 1 diabetes compared to non-diabetics.

What are the clinical implications of the study?

This study highlights the role of host response in gingivitis based on an equivalent bacterial challenge in diabetics. Diabetes is a condition which can result in oral inflammation attributed to an overproduction of inflammatory mediators and enzymes which can stimulate the degradation of the periodontal tissue. This study found that young type 1 diabetics developed an earlier and significantly higher inflammatory response to a comparable bacterial challenge than healthy non-diabetic controls.

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There is data to support the concept that active inflammatory disease can trigger insulin resistance, thereby hindering glycemic control. This could compromise the control of diabetes and subsequently increase the prevalence and severity of periodontal disease. The host-mediated response could affect glycemic regulation, leading to a cycle of events that would further compromise the periodontium. So while several studies have shown that systemic disease can have an effect on the oral health of the individual, there is also a growing body of evidence that oral infections and inflammation can have an impact on systemic health, suggesting a bi-directional relationship between systemic and oral health.

As part of the dental practitioner's risk assessment, oral hygiene is critical in diabetic individuals because, as demonstrated in this investigation, it does not take much plaque to stimulate a profound gingival response, even in a patient who has good-to-moderate metabolic control. In this study, gingivitis occurred more rapidly and was more severe in the diabetic subjects with poor oral hygiene than in the non-diabetic controls.

How should the results of this study impact treatment of my patients?

Important factors to consider in assessing the periodontal status of and formulating treatment plans

for patients with diabetes include their degree of metabolic control, the duration of their disease, the presence of other long-term complications of diabetes, and the presence of concurrent risk factors for periodontal diseases. In addition, communicate with the patient and their physician to determine their level of metabolic control and their general level of well-being.

Oral hygiene instructions are an important part of the treatment plan for all patients, particularly for high risk patients such as those with diabetes. Treatment should focus on the prevention of periodontal disease and oral inflammation, which is essential in controlling the oral complications associated with type 1 diabetes.

The replication of Loe's experimental gingivitis model demonstrates the powerful role of oral hygiene in preventing and controlling gingival inflammation. Emphasis should be placed on the reduction of the bacteria and elimination of the biofilm, both supragingivally and subgingivally. This can be accomplished with traditional scaling and root planing, in addition to excellent home care. And because we know that bacterial challenge is a risk factor for gingivitis among even healthy, well-controlled young diabetic

... because bacterial challenge is a risk factor for gingivitis among even healthy, well-controlled young diabetic patients, patients should be encouraged to floss regularly and to brush twice daily with a dentifrice containing triclosan, an ingredient which has proven antibacterial and anti-inflammatory benefits.

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This study shows that when oral hygiene was reinstated in subjects, with good-to-moderate metabolic control, an excellent response was seen within 14 days, with clinical resolution of the gingival inflammation.



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