Factors associated with the clinical response to nonsurgical periodontal therapy in people with type 2 diabetes mellitus

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ABSTRACT

Background. Type 2 diabetes mellitus (T2DM) is a growing health problem worldwide. People with T2DM are at risk of experiencing periodontitis and likely require treatment. Using data from the national multicenter Diabetes and Periodontal Therapy Trial (DPTT), the authors assessed patient-based characteristics associated with the clinical response to nonsurgical therapy.

Methods. The DPTT investigators randomly assigned adults with T2DM (hemoglobin A_{1c} [HbA_{1c}] ≥ 7 percent and < 9 percent) and moderate to advanced periodontitis to receive immediate or delayed therapy (scaling and root planing, oral hygiene instruction, chlorhexidine rinse). The investigators assessed probing depth (PD), clinical attachment level (CAL), bleeding on probing (BOP), and medical conditions at baseline, three months and six months. Six-month changes in mean PD, CAL and BOP defined the treatment response. Complete data were available for 473 of 514 DPTT participants. The authors used multiple regression models to evaluate participant-level factors associated with the response.

Results. More severe baseline PD, CAL and BOP were associated with greater improvements in these same measurements ($P < .0001$). Hispanic participants experienced greater improvements in PD and CAL than did non-Hispanic participants ($P < .0001$). Obese participants (those with a body mass index > 30 kilograms per square meter) experienced greater reductions in PD and BOP than did participants who were not obese ($P < .001$). Age, sex, HbA_{1c} values, diabetes duration, and smoking were not associated with change in any outcome ($P > .1$).

Conclusions. In patients with T2DM, baseline disease severity was associated with the clinical response to nonsurgical periodontal therapy. Body mass index and Hispanic ethnicity—but not glycemic control, diabetes duration or smoking—also may be useful in predicting clinical changes in this population.

Practical Implications. These findings could help clinicians identify patients with T2DM who may or may not respond well to initial periodontal treatment.

Key Words. Diabetes mellitus; periodontitis; treatment.

JADA 2014;145(12):1227-1239. Clinical Trials.gov identifier NCT00997178.

doi:10.14219/jada.2014.92

Nonsurgical periodontal therapy is an effective means of reducing signs of periodontitis.[1] Many reports have documented the range of treatment responses, and it is well established that sites with initially more severe disease experience greater clinical improvements after treatment when compared with less severely affected sites.[2-4] In contrast, less is known about the utility of patient-based characteristics in predicting the clinical response to nonsurgical therapy. One exception is smoking, which is known to affect treatment response adversely.[5]

Haffajee and colleagues[6] compared baseline clinical characteristics between people who responded well and poorly to scaling and root planing and found no significant differences between the groups in any baseline clinical parameter. Several bacteria, however, including *Actinomyces viscosus* and *Treponema denticola*, were more prevalent and at higher levels at baseline in those who responded well versus those who responded poorly. In patients with aggressive periodontitis, smoking and higher initial attachment loss, but not bleeding and probing depth (PD), have been associated with a poor response to scaling and root planing.[7]

Little is known about treatment response predictors in patients with type 2 diabetes mellitus (T2DM). In fact, intervention trials frequently exclude patients with medical conditions, including diabetes, that are known to affect a person's risk of experiencing periodontitis. Yet T2DM is a substantial and growing health problem in the United States and worldwide. An estimated 29 million Americans have diabetes.[8] Because they are at increased risk of experiencing periodontitis,[9] people with T2DM may have more periodontal treatment needs than do otherwise healthy people.

Although diabetes is believed to affect response to periodontal treatment adversely,[10] there is sparse evidence to support this. Investigators in several small trials found comparable clinical responses after scaling and root planing in patients with and without diabetes.[11-13] To the best of our knowledge, no investigators

have published studies in which they have explored predictors of periodontal treatment response in patients with T2DM. We explored associations between baseline characteristics and the periodontal treatment response in people with T2DM who participated in the Diabetes and Periodontal Therapy Trial (DPTT). This report focuses on patient-level, and not tooth-level, factors that could be used by a clinician to assess a person's likelihood of responding to treatment.

METHODS

Design and setting. DPTT was a multicenter, six-month, single-masked,randomized controlled trial designed to test whether periodontal therapy improves glycemic control in participants with T2DM and moderate to advanced periodontitis. A prespecified secondary aim of the trial was to assess the clinical efficacy of periodontal therapy in participants in terms of the periodontal status or condition being evaluated, which is a focus of this report. The study protocol was approved by the institutional review board at each participating center: University of Alabama at Birmingham; University of Minnesota, Minneapolis; Stony Brook University, State University of New York; University of Texas at Houston; and University of Texas at San Antonio. All participants provided written informed consent.

The trial's primary outcome was change in hemoglobin A_{1c} (HbA_{1c}) six months after random assignment to study group. The trial's design and primary results have been described elsewhere.[14,15] Briefly, DPTT investigators randomly assigned 514 participants (recruited as described elsewhere[14]) to groups receiving either immediate or delayed periodontal treatment between November 2009 and March 2012. Treatment group participants received at least 160 minutes of scaling and root planing in two to four visits, used a daily chlorhexidine mouthrinse for at least one month, and received supportive periodontal therapy at three and six months after study group assignment. Therapists used powered scalers and hand curettes. Local anesthetic (applied topically or injected) was used as needed. Completeness of therapy was assessed by the study therapist and confirmed by a study periodontist. Both treatment and control groups received oral hygiene instructions and information on healthy living at the baseline visit. All participants were monitored by the same group of trained examiners using calibrated technique for periodontal disease progression three and six months after study group assignment. Participants with progressive disease received localized or full-mouth scaling and root planing, depending on the extent of disease progression. Control participants were offered full-mouth scaling and root planing after six months.

Data collection. Examiners using calibrated technique obtained clinical periodontal measurements by using manual probes (University of North Carolina–15). They examined participants at baseline and three and six months after study group assignment. They assessed PD, the distance from the cementoenamel junction to the gingival margin (CEJ-GM) and bleeding on probing (BOP) at six sites on all teeth except third molars. They computed clinical attachment level (CAL) for each site from the PD and CEJ-GM measurements. They scored dental plaque at each tooth site as detectable (1) or undetectable (0, with a probe or visually) and computed it as a full-mouth percentage.

Outcome assessment. We assessed change in clinical periodontal status by using three outcomes: six-month change from baseline in full-mouth mean PD, full-mouth mean CAL and the percentage of tooth sites with BOP. Our study included data from 473 participants (240 treatment group participants and 233 control participants) of the 514 participants for whom complete baseline and six-month periodontal data were available.

Statistical analysis. We used individual analysis of variance or Pearson product moment correlations initially to explore bivariate associations between change in full-mouth mean PD, CAL and BOP and the following baseline factors: baseline disease severity (quartile split), treatment group (immediate treatment or delayed treatment [control]), age (in years), sex, race (African American, white or other), ethnicity (Hispanic or non-Hispanic), smoking history (current, former, or never), HbA_{1c} level (percentage), duration of diabetes (self-reported, in years), body mass index ([BMI] in kilograms per square meter, ≤ 30 versus > 30), full-mouth average clinical measurements, dental plaque, diastolic blood pressure (in millimeters of mercury), self-reported overall health and brushing and flossing frequency, and clinical site.

We constructed multiple regression models to evaluate associations between changes in periodontal measurements with various baseline factors simultaneously. We considered factors with P values < 0.1 in bivariate associations with the outcome of interest (change in PD, CAL or BOP) for inclusion in the regression models. We also evaluated all two-way interactions between these factors. We used backward selection to determine the final model. We removed nonsignificant interactions and factors ($P > .05$), and the final models included only factors significantly associated with the outcome. We selected factors by using an F test based on a type 3 sum of squares. We reported both unadjusted P values and P values with Bonferroni adjustment for multiple tests.

The clinical enrollment site was statistically significant in each model. Because our goal was to explore predictors useful to a clinician, in this article we do not report the clinical site effect, although it was adjusted in

ABBREVIATION KEY. **BMI:** Body mass index. **BOP:** Bleeding on probing. **CAL:** Clinical attachment level. **CEJ-GM:** Cementoenamel junction to the gingival margin. **DPTT:** Diabetes and Periodontal Therapy Trial. **HbA_{1c}:** Glycated hemoglobinA_{1c}. **PD:** Probing depth. **T2DM:** Type 2 diabetes mellitus.