Periodontal Disease and Incidence of Type 2 Diabetes Mellitus

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Abstract

Chronic inflammation caused by periodontal disease has been associated with various systemic conditions including type 2 diabetes. A few published longitudinal studies show a relation between periodontitis and poor glycemic control among diabetics. To our knowledge, this is among the first prospective studies to assess whether periodontal disease and tooth loss are related to risk of type 2 diabetes. This study utilized data from two prospective cohort studies, including 51,529 men aged 40-75 years in the Health Professionals' Follow-up Study (HPFS) followed for 18 years (1986-2004) and 104,064 women aged 34-59 years from the Nurses' Health Study (NHS) followed for 12 years (1992-2004). Participants free of CHD, cancer and type 2 diabetes at baseline were followed for subsequent reports of newly diagnosed type 2 diabetes; diabetes reports were subsequently verified from medical records. Self-reported periodontal disease and other information was assessed by validated mailed questionnaires. Cox proportional hazards models with time-dependent variables, were used to compute rate ratios (RR) relating periodontal disease to incidence of type 2 diabetes. We adjusted for age, smoking, family history of diabetes, physical activity, body mass index, alcohol, diet (sugar-sweetened soft drinks, fiber, glycemic load and polyunsaturated: saturated fat ratio) and only among women menopause status and post-menopausal hormone use. The multivariate RR for periodontitis (comparing moderate/severe versus none/mild) was 1.17 (95% CI: 0.97-1.42) in men and 1.20 (95% CI: 0.96 -1.50) in women. When a binary measure of periodontitis was updated using biennial questionnaires the RR was 1.38 (95% CI: 1.17-1.61) in men; similar updated data was not available in women. The multivariate RR for tooth loss (≥1 vs. 0 teeth lost during follow-up) was 1.25 (95% CI: 1.12 -1.40) in men and 1.14 (95% CI: 1.06 - 1.22) in women. The associations among men persisted among never smokers. Our results suggest that periodontal disease and fewer teeth may be related with increased risk of type 2 diabetes.

Introduction

• Periodontal disease may be associated with an increased risk of systemic inflammation and also with several systemic diseases.
• Inflammatory markers are significant predictors of type 2 diabetes.
• Several studies have shown that periodontal treatment may improve glycosylated hemoglobin levels in patients with type 2 diabetes.
• In a prospective study among subjects with type 2 diabetes, participants with periodontitis had a higher adjusted risk of poor glycemic control.
• Only one recent study assessed the relation between periodontal disease, tooth loss and incidence of type 2 diabetes and found positive associations.
• Our study is among the first prospective cohort to evaluate the relation between periodontal disease, tooth loss and incident type 2 diabetes.

Biological Pathways: Periodontal Disease, Systemic Inflammation and Diabetes
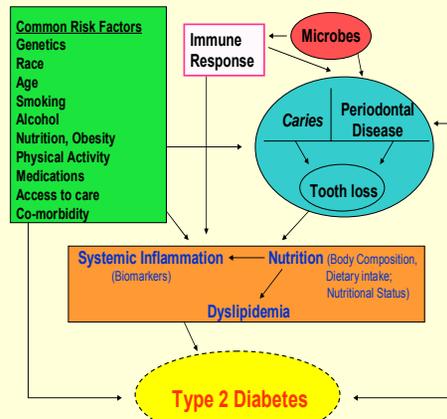
Methods

Cohort populations: 51,529 men participating in the Health Professionals' Follow-up Study responded to 1986 questionnaire; 104,064 women participating in Nurses Health Study responded to the 1992 questionnaire

Follow-up: 1986 – 2004 (in HPFS cohort); 1992 – 2004 (in NHS cohort)

Exclusions: Baseline CHD and cancer history, and history of diabetes prior to each follow-up period

Outcome: Incident type 2 diabetes confirmed from medical records using National Diabetes Data Group criteria. (Elevated glucose and at least one symptom related to diabetes OR no symptoms but elevated glucose concentrations on 2 occasions OR treatment with insulin or oral hypoglycemic medication). There were 3646 confirmed cases in NHS and 2343 in HPFS

Exposures: Baseline and updated history of periodontal disease, baseline number of teeth, and tooth loss during follow-up and past 2 years.

Confounders: Models presented here controlled for age, smoking, family history of diabetes, physical activity, body mass index, alcohol, and diet (glycemic load, cereal fiber, sugar-sweetened soft drinks, polyunsaturated: saturated fat ratio), and only among women menopause status and post-menopausal hormone use. All confounders were updated over time.

Results

Age-adjusted Characteristics by Periodontal Disease

	Periodontal Disease			
	NHS		HPFS	
	No	Yes	No	Yes
Age (years)	63.3	63.3	52.1	56.5
BMI (kg/m^2)	25.8	26.3	24.9	24.9
Physical activity (MET†/week)	24.9	22.3	26.1	26.2
Alcohol intake (g/day)	6.9	5.2	11.6	13.2
Current smoking (%)	0.8	0.5	0.1	0.2
Family history of diabetes (%)	0.2	0.2	0.2	0.2
Glycemic load (g)	112.7	116.0	124.7	122.1
Fiber (g/day)	6.0	6.2	5.7	5.4
Sugared soft drinks (cans/day)	0.2	0.2	0.3	0.3

Relationship Between Periodontal Disease, Tooth Loss and Diabetes

	Multivariate adjusted RR* (95% CI)	
	NHS	HPFS
Baseline teeth # (25-32=ref)		
17-24	1.15 (1.05, 1.24)	1.04 (0.92, 1.19)
16-11	1.24 (1.08, 1.42)	1.08 (0.82, 1.41)
0-10	1.34 (1.21, 1.48)	1.12 (0.88, 1.43)
Periodontal disease (no=ref)		
Baseline history	NA	1.08 (0.96, 1.21)
Updated history	NA	1.32 (1.15, 1.51)
Severity of periodontal disease		
Moderate/Severe -	1.20 (0.96, 1.50)	1.17 (0.97, 1.42)
≥ 1 Tooth Lost (no=ref)		
In last 2 years	1.18 (1.08,1.28)	1.29 (1.11, 1.50)
During follow up	1.14 (1.06, 1.22)	1.25 (1.12, 1.40)
Periodontal surgery (no=ref)		
Yes	1.05 (0.93, 1.19)	NA

Relation Between Updated Periodontal Disease, Tooth Loss During Follow up and Diabetes Among Sub-groups

	Periodontal Disease	Tooth Loss
	Multivariate RR	Multivariate RR
Ever smoker	1.32*	1.25*
Never smoker	1.66*	1.31*
Physical activity quintile 1	1.34*	1.38*
Physical activity quintile 5	1.38	1.00
Family history of DM	1.29*	1.04
No family history of DM	1.32*	1.34*
Normal BMI (kg/m^2)	1.29	1.51*
Obese (BMI > 30)	1.26*	1.11

* p<0.05

Conclusions

• Among men, both periodontal disease and tooth loss during follow up were associated with increased incidence of type 2 diabetes.
• These associations were stronger among never smokers and men with no family history of diabetes.
• Among women, fewer baseline number of teeth and tooth loss during follow-up were significantly associated with incidence of type 2 diabetes, but there was no association with periodontal disease.
• These preliminary analyses suggest that periodontal disease and tooth loss may be related with an increased risk of type 2 diabetes.

Acknowledgements