## ORIGINAL ARTICLE

L Commisso M Monami E Mannucci

# Periodontal disease and oral hygiene habits in a type 2 diabetic population

#### Authors' affiliations:

*L Commisso*, Dental Hygienist, Florence, Italy *M Monami, E Mannucci*, Section of Geriatric Cardiology, Department of Cardiovascular Medicine, University of Florence and Careggi University Hospital, Florence, Italy

#### Correspondence to:

*Laura Commisso* Via Kassel 30 50126 Firenze, Italy Tel.: +0039 0556533007 Fax: +0039 055475377 E-mail: lauracom@inwind.it

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© 2009 The Authors. Journal compilation © 2009 Blackwell Munksgaard Abstract: Objectives: Periodontal disease is a serious oral health problem that is observed in patients with diabetes mellitus. The aim of the present study is to observe the oral health condition in a diabetic type 2 population in connection with glycaemic control and lifestyle. Materials and methods: A questionnaire was distributed to 118 patients in a centre for diabetics to collect information, such as date of birth, year of onset of diabetes, diabetic parameters, pharmacological therapy and oral hygiene habits. An oral examination was conducted to evaluate the presence of plaque, calculus, tooth mobility, caries and gingivitis. In a sub-group scaling and root planning (SRP) was completed. Results: Thirty-one of 118 patients were edentulous and were excluded from the main analysis. Nearly 60% of patients presented dental plaque and gingivitis. A statistically significant difference in patients with or without a glycaemic control was only observed in women. Patients treated with SRP had significant better oral health and a slight reduction of HbA1c. Conclusion: Poor oral health care was observed in the diabetic population. The high risk of periodontal disease needs the attention of dental hygienist.

Key words: diabetes; glycaemic control; oral health care

## Introduction

Diabetes mellitus (DM) is a systemic disease with several complications which may affect both the quality and length of life. The chronic hyperglycaemia condition of diabetes is associated to long-term micro- and macrovascular dysfunctions: retinopathy, neuropathy, nephropathy and cardiovascular disease. Periodontitis is considered one of these complications (1). Periodontal disease is one of the serious oral health problems noticed in patients with DM. The effect of DM on the oral cavity has been well researched and will be reviewed only briefly. Evidence has shown that diabetes is a risk factor for gingivitis and periodontitis (2, 3). The mechanisms responsible in patients affected by diabetes are mostly related to the increased risk of infection, impairment of the synthesis of collagen and glycosaminoglycan by gingival fibroblasts, increased crevicular fluid collagenolytic activity and also reduced function of granular neutrophils (4-7). The degree of glycaemic control is a relevant variable in the relationship between diabetes and periodontal disease, there is higher prevalence and severity of gingival inflammation and periodontal destruction seen in those with poor glycaemic control (8-13). Epidemiological studies have shown that diabetes increases the risk of alveolar bone loss and attachment loss, approximately threefold, compared with non-diabetic individuals (14, 15). These results have been confirmed by meta-analyses of studies in different diabetic populations (3). Longitudinal studies state that diabetes increases the risk of progressive bone loss and attachment loss over time (16). Periodontal disease is inflammatory in nature; as such it may alter glycaemic control. Diabetic patients with periodontal infection have a higher risk of worsening glycaemic control over time compared with diabetic subjects not affected by periodontitis (15). Several studies (5, 17-20) on subjects affected by diabetes with severe periodontitis have showed improvement in glycaemic control following scaling and root planning (SRP). After the treatment of periodontal disease with antibiotics, the result showed a significant reduction in periodontal infection and inflammation. This was followed by a short-term reduction of glycated haemoglobin level. However, two recent reviews showed found that extreme caution should be taken regarding the research because it has been evidenced that no sufficient random clinical trials exist (21, 22). A meta-analysis (23) has tested the null hypothesis that 'periodontal treatment does not affect glycaemic control in patients with diabetes'. This has shown a non-significant statistical reduction of HbA1c (-0.38%), more evident in patients suffering from type 2 diabetes. Despite this, the authors cannot reject the null hypothesis and point out the need of further studies with a larger sample size of diabetics type 2. Similar results come from a clinical trial review recently published (24).

The purpose of this study is to investigate oral health and its possible correlations with clinical and laboratory parameters in the diabetic mellitus type 2 patients. In a sub-group of patients with periodontitis, SRP were performed and the results have been evaluated.

### Materials and methods

Patient recruitment and criteria: all the patients were examined at the Diabetes Day Hospital of the Geriatric Functional Unit of the University of Florence, Italy, between July and September 2008 (n = 158) were proposed for evaluation of their oral health.

Forty of them refused the medical examination, 31 were edentulous and so excluded from the main analysis. A questionnaire was distributed in order to attain information concerning date of birth, year of onset of diabetes, complications related to diabetes, clinical parameters of diabetes, drug therapy and oral hygiene habits, the presence of signs and symptoms that the patients note such as gingival bleeding while brushing, hot and cool sensitivity. Informed consent was obtained by all the subjects. The recorded parameters are the following: plaque index (PI) by Silness and Loe (1964) (25), presence of calculus, caries, tooth mobility, and presence of gingivitis. The patients were asked to fast the night before the blood sample was taken for glycated haemoglobin (HbA1c), cholesterol, high density lipoprotein (HDL), triglycerides. Total cholesterolaemia, HDL and triglycerides were determined by automated methods (Aeroset; Abbott Laboratories, Campoverde di Aprilia, Italy), HbA1c with a chromographic technique with HPLC (Menarini Diagnostics, Florence, Italy; upper limit normal range 6.2%).

For the treatment, the following criteria were included for all patients:

- Plaque index  $\geq 2$
- Presence of gingival bleeding
- Deep pocket ≥5 μμ ιν τωο διφφερεντ σεξταντ
- At least five teeth in oral cavity And the following criteria for exclusion:
- Severe compromising diseases (for example cancer in advanced stage, renal or hepatic failure, congestive heart failure)
- Treatment with bisphosphonates

Scaling and root planning was offered free of charge to all patients who met the inclusion criteria and the following parameters were recorded: PI (Axelsson e Lindhe), bleeding index (Ainamo e Bay) and probing depth.

Statistical analysis was attained by the use of the SPSS 12.0.1. program. Data is expressed as mean  $\pm$  SD or like median (quarters) and has been compared between groups with Student's *t*-test or Mann–Whitney *U*-test if they had normal or no distribution. Chi-square test was used for the comparison between groups of categorical variables. An alternative model of binary logistic analysis adjusted for age was carried out (divided

Table 1. Characteristics of oral health care of patient sample

	Total <i>n</i> = 87
Use toothbrush	
2–3 times per day	62 (72.2%)
1 time per day	21 (24.2%)
Occasionally	4 (4.6%)
Use dental floss or interdental brushes	
Regularly	15 (17.24%)
Occasionally	13 (15%)
No	59 (67.8%)
Professional dental hygiene	
2–3 times per year	16 (18.4%)
1 time per year	25 (29%)
Never	46 (52.6%)

Most of the patients use regularly toothbrush but does not clean inter-proximal areas and did not professional dental hygiene.

between female and male) including the following parameters: PI  $\geq 2$ , hot and cool sensitivity and both, presence of calculus, plaque and both, a patient group with HbA1c <8% was used as reference. Wilcoxon rank-sum test was utilized to compare the baseline values that were taken 2 months previously with those of the patients who underwent SRP 2 months after.

### Results

An analysis of questionnaires has shown that 31 patients (26.3%) are edentulous, of the remaining 87, only 62 declared to use a toothbrush two or three times a day, 21 patients once a day, and 4 occasionally. Only 15 people use dental floss or interdental brushes regularly, 13 occasionally, 59 did not know of their existence. The frequency by which the patients

Table 2. Demographic characteristics of the study population

returned for professional dental hygiene is as follows: 16 two to three times a year, 25 once a year, 46 never (Table 1). The only difference between edentulous or not edentulous patients is the age and the duration of the onset of the disease. There are higher in edentulous patients (Table 2). An analysis of comparison between patients with HbA1c ≤8% has shown that women have a higher prevalence of plaque and calculus, in the group with poor glycaemic control (Fig. 1). Regarding men, there is no statistically significant difference between the two groups (Fig. 2). It was observed, for the PI in women, that there is an increase of the value of the HbA1c correlated to a number of patients with a very poor oral hygiene, in men there is no correlation between the two parameters (Fig. 3). A binary logistic analysis, divided by gender, adjusted for age, has shown that women with HbA1c  $\geq 8\%$  have a higher risk of calculus and an increase of the risk of higher PI (Fig. 4). The comparison between patients who usually attend a dental office and those who do not has shown that those who attend regularly a dentist or a dental hygienist have a lower PI, less bleeding during tooth brushing and less gingivitis (Table 3). Thirteen of the 23 patients who were proposed to have SRP refused treatment, one patient has been treated but has not return for a control visit, therefore, has been excluded from the trial. The collected data will refer to nine patients. Regarding periodontal parameters, the mean of the plaque at the first visit was 52.72%, bleeding on probing 52.3%, deep pocket 5.7 mm. An analysis for media for independent samples has shown a statistically significant reduction of plaque, bleeding on probing and deep pocket depth at the control, and a tendency to HbA1c decreasing (Fig. 5).

	Total ( <i>n</i> = 118)	Non-edentulous ( $n = 87$ )	Edentulous ( $n = 31$ )	<i>P</i> -value
Age (years)	63.6 ± 13.8	60.6 ± 14.2	72.0 ± 8.5	<0.001
Women (%)	54 (45.8)	37 (42.5)	17 (54.8)	ns
Duration of diabetes (years)	14.7 ± 13.3	12.6 ± 12.6	20.4 ± 13.7	0.005
HbA1c (%)	7.9 ± 1.5	7.7 ± 1.4	8.3 ± 1.8	ns
Glycaemia (mg dl <sup>-1</sup> )	168 ± 69.6	168.8 ± 75	169.8 ± 51.8	ns
Cholesterol (ml $dl^{-1}$ )	188.7 ± 54	190.1 ± 45.8	184.7 ± 44.5	ns
HDL (mg dl <sup><math>-1</math></sup> )	49.6 ± 15.	49.5 ± 5.9	50.0 ± 15.7	ns
LDL (mg dl <sup><math>-1</math></sup> )	109.7 ± 35.9	112.4 ± 36.8	102.1 ± 32.6	ns
Triglycerides (mg dl <sup>-1</sup> )	133 (89.7, 187.0)	123 (90, 184)	140 (80, 197)	ns
Diabetes complications				
Retinopathy (%)	14 (11.9)	8 (9.2)	6 (19.4)	ns
Neuropathy (%)	17 (14.4)	10 (11.5)	7 (22.6)	ns
Cardiovascular disease (%)	15 (12.7)	10 (11.5)	5 (16.1)	ns
Drug therapy	. ,			
Metformin (%)	77 (65.3)	55 (64)	22 (71)	ns
Insulin secretagogue (%)	26 (22) 999	15 (17.2)	11 (35.5)	ns
Insulin (%)	56 (47.5)	39 (44.8)	17 (548)	ns
Glitazoni (%)	2 (1.7)	2 (2.3)	0 (0.0)	ns

Only the age and duration of diabetes are significantly different between patients with or without teeth in oral cavity.



Fig. 1. Association between periodontal per dental parameters and glycaemic control in women.



Fig. 2. Association between periodontal per dental parameters and glycaemic control in men.

#### Discussion

The risk of developing periodontal disease is higher in diabetic patients, especially in subjects with poor glycaemic control (26–29); it has also been observed that the relationship between the two diseases is bidirectional. In our case, it has been found that over 2/3 of the subjects have gingivitis, 75% plaque and 80% presence of calculus (Table 4). From the acquired data, less than 50% regularly visit a dental office. It should be noted that the observed level of oral hygiene, actually corresponds to the reality because the patients did not know about dental visit before. It seems that the patients were never informed about the importance of regular dentist control examinations. This study has not confirmed the relationship between HbA1c and periodontal diseases but has shown a sta-



Fig. 3. Plaque index in relation with glycaemic control in women and men.

tistically significant correlation between HbA1c  $\geq$ 8, PI ( $\geq$ 2) and presence of calculus. Moreover, this correlation is confirmed by the results of the second part of the study, where the levels of HbA1c decreased after non-surgical treatment. These results refer to the female population and are not confirmed in the male population. Other previous studies have reported differences in oral care behaviour between men and women (30–32). The homogeneity of the female group could be interpreted as a more predictable and constant behaviour towards oral health.

The nine patients treated have shown results in line with the literature (3, 33) with a significant reduction of the considered parameters (PI, bleeding index, deep probing) and a reduction of the limits of statistical significance of HbA1c.



Fig. 4. Multivariate analysis.

## Table 3. Comparison between the variables and oral hygiene's patients

	Total <i>n</i> = 87		
	Yes	No	P-value
Plaque index (%)			
0	29.3	6.5	0.008
1	29.3	19.6	
2	31.7	47.8 <b>)</b>	
3	9.8	26.1	
Bleeding on brushing (%)	30.3	69.7	0.014
Hot sensitivity (%)	44.4	55.6	0.798
Cool sensitivity (%)	48.1	51.9	0.759
Calculus (%)	75.6	84.8	0.281
Gingivitis (%)	34.5	65.5	0.001

Patients who regularly go in dental office have a lower plaque index, refer less bleeding on brushing and less presence of gingivitis. No significantly difference in hot or cool sensitivity or presence of calculus.

## Table 4. Percentage of variables analyzed of the study population

	Total <i>n</i> = 87
Plaque index (%)	
0	15 (17.2)
1	21 (24.1)
2	35 (40.2)
3	16 (18.4)
Visit to dental office (%)	41 (47.1)
Bleeding on brushing (%)	33 (37.9)
Hot sensitivity (%)	18 (20.7)
Cool sensitivity (%)	27 (31.0)
Calculus (%)	70 (80.5)
Tooth mobility (%)	18 (20.7)
Caries (%)	8 (9.2)
Gingivitis (%)	58 (66.7)

Low oral self-care, presence of gingivitis and calculus is present in more than 50% of patients. Less than 50% regularly go to dental office.



Fig. 5. Results in patients treated with scaling and root planning.

However, consideration must be given to the fact that the sample site observed in this study is limited in number and further random trial studies are needed.

## Conclusion

The periodontal health of the observed population reinforces the need of establishing a comprehensive oral health prevention programme for diabetic patients. More cooperation is necessary between those involved in the general health and the dental care of diabetics. The dental hygienist could and should support the diabetic team with the aim to educate patients in oral self-care. It has been shown that patients comply with recommendations more readily from dental hygienists than recommendations from dentists (34); the dental hygienist can also be useful to intercept initial signs and symptoms of periodontal disease, especially the transition from gingivitis to periodontitis.

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