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Compromised periodontal status in an urban Sri Lankan population with type 2 diabetes

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Abstract

Aim: To determine the prevalence of periodontitis in an urban population of Sri Lankans with type 2 diabetes (T2DM) and to compare the data with those from a population of adults without diabetes.

Methods: Demographic data and a diabetes profile were recorded for a population of urban Sri Lankan adults with T2DM including duration of diabetes, blood pressure; percentage glycosylated haemoglobin, fasting blood glucose level, total cholesterol; triglycerides, low- and high-density lipoproteins. The clinical examination comprised an oral soft tissue examination, full-mouth probing depths (PD), gingival recession (GR), clinical attachment levels and bleeding on probing (BoP).

Results: Two hundred and eighty-five individuals with T2DM and 72 controls were examined. 33.3% of T2DM patients were diagnosed with chronic periodontitis compared with 21.7% of controls ($p = 0.077$). Subjects with T2DM had significantly more sites with PD $\geqslant 4$ and $\geqslant 5$ mm ($p < 0.01$), and higher mean GR and BoP scores ($p < 0.01$).

Conclusion: This urban Sri Lankan population of subjects with T2DM demonstrated a compromised periodontal status compared with non-diabetic controls.

Keywords: periodontitis; type 2 diabetes

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Diabetes is a massive burden to public health across the world and global estimates suggest that the prevalence will continue to increase significantly over the next 25–30 years (International Diabetes Federation 2007). Local estimates have suggested that prevalence in rural populations is approximately 25% of that found in urban areas (Ramachandran et al. 1999, Wild et al. 2004) and the projected increased prevalence of the disease, particularly in developing countries, is at least in part, a consequence of urbanization of rural areas, which is associated with changes in diet, obesity, levels of physical activity and stress.

Based on these projections, the implications for oral health and the provision of dental care are also significant as the association between diabetes and periodontitis has been established unequivocally through numerous cross-sectional studies (Nelson et al. 1990, Shlossman et al. 1990, Emrich et al. 1991, Taylor et al. 1998, Cutler et al. 2000, Sandberg et al. 2000, Tsai et al. 2002, Engebretson et al. 2004, Lu & Yang 2004, Campus et al. 2005, Jansson et al. 2006, Mattout et al. 2006, Peck et al. 2006). Further, this association is particularly pronounced in populations with high prevalence rates of diabetes (Nelson et al. 1990, Emrich et al. 1991) and also for those subjects with poor or unstable glycaemic control (Tsai et al. 2002, Engebretson et al. 2004, Peck et al. 2006).

The prevalence of diabetes in Sri Lanka is reported as being between 10% and 14% (Malavige et al. 2002, Wijewardene et al. 2005, Katulanda et al. 2008) and this also has increased significantly over the last two decades (Illangasekera et al. 1993, Fernando et al. 1994, Malavige et al. 2002, Wijewardene et al. 2005, Katulanda et al. 2008). In a recent study of 5000 adults, 36% of all diabetic subjects were undiagnosed previously. Diabetes prevalence was significantly higher in the urban population compared with rural (16.4% *versus* 8.7%) and overall, 21.8% of subjects had some form of dysglycaemia. Those with diabetes and pre-

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diabetes compared with normal glucose tolerance were older, physically inactive, had a family history of the disease, a higher body mass index (BMI), waist circumference, waist–hip ratio, systolic/diastolic blood pressure, low-density lipoprotein, cholesterol and triglycerides (Katulanda et al. 2008). Further, although a survey of newly diagnosed Sri Lankans with diabetes reported the prevalence of established diabetes complications in this population (Weerasuriya et al. 1998), there has only been one preliminary report of the prevalence of periodontitis as being the sixth complication of diabetes in this population (De Silva et al. 2006).

The prevalence and progression of periodontitis in Sri Lankans has been reported in the eloquent series of natural history studies of the 1970s and 1980s (Löe et al. 1978a–c, 1986, Anerud et al. 1979). The population (tea plantation workers) was rural, geographically isolated and had no history of dental care or intervention. There was also an unusually high prevalence of both aggressive and chronic periodontitis with significant progression of the disease at around 30 years of age and leading to tooth mortality at around 40 years (Ekanayaka 1984, Löe et al. 1986). The suggestion that this susceptibility might be associated with the prevalence of virulent microorganisms (Greene 1986) was unconfirmed by later data that found profiles of *Prevotella intermedia*, *Porphyromonas gingivalis* and *Actinobacillus actinomycetemcomitans* as being similar to those reported in other non-industrialized and industrialized countries (Preus et al. 1995). Subsequent reports investigated the potential associations with risk factors including clinical parameters, use of betel nut and smoking (Neely et al. 2001, 2005), although a link to the prevalence of diabetes was not explored. This may well have been informative as these Tamil-speaking plantation workers were originally brought from southern India where the prevalence of diabetes was, and continues to be, among the highest in southeast Asia (International Diabetes Federation 2007). Nevertheless, there is no available literature reporting epidemiological data to substantiate an association between periodontal status and diabetes status in Sri Lankans. The aim of this study, therefore, was to determine the prevalence of periodontitis in an urban population of Sri Lankans with type 2 diabetes (T2DM) and to compare the data with those from a population of adults without diabetes.

Methods

Study design

This was a cross-sectional study of the periodontal status of a population of urban Sri Lankans with a diagnosis of T2DM compared with a matched, local, control population who did not have a diagnosis of T2DM. Ethical approval was obtained with favourable opinions from both the ethics committee of the University of Sri Jayewardenepura and the Newcastle and North Tyneside research ethics committee.

Study populations

Subjects with an established diagnosis of T2DM were identified from a database of patients under the care of The Endocrinology and Metabolic Disease Trust, Colombo, Sri Lanka. Age- and sex-matched control subjects were recruited from the population of Colombo. Initial contact with subjects of both groups was initially through a written invitation to participate in the study followed by telephone call to confirm interest and then to attend a single appointment when written informed consent to participate was received.

Subjects were excluded from the study if they were edentulous or had known diagnoses of other systemic conditions affecting periodontal health such as rheumatoid arthritis or HIV infection.

Demographic data

The following data were recorded: age, gender, height, weight, BMI, smoking status, and alcohol consumption.

Diabetes profile

The diabetes profile comprised: known duration of diabetes; systemic and diastolic blood pressure; percentage glycosylated haemoglobin (HbA1c); fasting blood glucose level (FBG); total cholesterol; triglycerides; low-density lipoproteins; and high-density lipoproteins.

Subjects with a diagnosis of T2DM were categorized into good, moderate and poor glycaemic control based on their clinical records of HbA1c: good control when HbA1c $\leqslant$ 7%, moderate control when HbA1c was between 7% and 8.5%, and poor control when HbA1c was $\geqslant$ 8.5% (Qaseem et al. 2007).

Blood samples were analysed at the Durdans Molecular Diagnostic Laboratory, Colombo City, Sri Lanka. Samples were dispatched on the day of collection with results received within 24 h as part of the subjects' routine diabetes management. Control blood samples were analysed by the same laboratory in parallel with the subjects with diabetes.

Periodontal status

A comprehensive periodontal examination was undertaken using a disposable, manual, pressure-sensitive TPS periodontal probe (Vivadent, Schaan, Lichtenstein). The clinical examination comprised:

- an oral soft tissue examination of the gingiva, buccal mucosa, lips, vestibule, palate, tongue and floor of mouth;
- probing depths (PD) recorded at six sites (mesiobuccal, midbuccal, distobuccal, mesiolingual, midlingual and distolingual) per tooth (excluding the third molars) and was measured as the distance from the free gingival margin (FGM) to the apical extent of the probe tip. The measurement was rounded up to the nearest millimetre;
- gingival recession (GR) was also recorded at six sites per tooth and was measured as the distance between the cemento-enamel junction (CEJ) and the FGM. The measurement was rounded up to the nearest mm. This measurement was recorded as positive when the FGM was apical to the CEJ and negative when the FGM was coronal to the CEJ;
- clinical attachment levels were calculated as the sum of the PD+GR measurements;
- bleeding on probing (BoP) was assessed following the PD and GR measurements. BoP was recorded as ''1'' (present) if it occurred within 30 s of probing and ''0'' (absent) if no bleeding occurred.

On completion of the oral examination, the subjects were provided with a verbal explanation of their dental needs with, when appropriate, a recommendation to visit their dental practitioner. A letter detailing the dental findings was

also provided to subjects to take to their dentist.

Periodontal status was classified as being one of the three categories:

- periodontal health – when there were no PD > 3 mm and BoP was < 15%;
- gingivitis – when there were > 15% sites BoP and with no PD > 4 mm;
- chronic periodontitis – when there were ⩾6 sites with PD ⩾ 5 mm.

The diagnoses were assigned following consideration of diagnostic criteria for periodontal disease that were proposed by the 2005 European Workshop of Periodontology and the 2007 CDC-AAP collaboration (Tonetti et al. 2005, Page & Eke 2007). Subjects who did not fit the above criteria were excluded from the analysis to ensure clear demarcation of periodontal diagnosis for analysis.

All control subjects were screened for possible diabetes based on their HbA1c and FBG data. They were classified as possibly having diabetes if HbA1c was > 6.1% and FBG was > 100 mg/dl (Saudek et al. 2008). If the FBG value was > 126 mg/dl, they were also categorized as possibly having diabetes. If FBG fell within 110–125 mg/dl, they were categorized as having impaired fasting glycaemia and if the FBG was < 110 mg/dl, they were considered to be normoglycaemic. Control subjects who were not normoglycaemic were excluded.

Statistical analysis

A power calculation was based on there being an estimated standard deviation of 0.6 mm in PD within the population. To detect a difference in mean PD of 0.3 mm between the groups and with 90% power and assuming a significance level of 5%, 271 subjects with diabetes and 50 controls would be required.

Statistical analyses were performed using SPSS version 15. Frequency distributions were determined and descriptive statistics were calculated as means, standard deviations and ranges. Categorical grouping variables included periodontal status (health, gingivitis, periodontitis) and diabetes status (good, moderate or poor control, non-diabetic). A cohort of subjects ($n = 12$) who, according to medical history were initially believed to be non-diabetic, transpired to have blood results suggestive of impaired glucose tolerance or possible diabetes, and were excluded. The impact of periodontal status on diabetes status (and vice versa) was determined using χ^2-statistics. Distributions of continuous variables were plotted and normality was tested using Kolmogorov–Smirnov statistics. For normally distributed variables, comparisons between groups were made using analysis of variance with post hoc Bonferroni corrections. For non-normally distributed variables, comparisons between groups were made using the Kruskall–Wallis test with post hoc Mann–Whitney tests to identify significant differences between groups. In the latter case, the critical value of $p = 0.05$ was adjusted according to the number of post hoc tests performed to avoid inflating the Type I error rate. For some analyses, all the diabetic subjects were collapsed into one group, and compared against the non-diabetic subjects. In these analyses, comparisons between the groups were made using unpaired *t*-tests (parametric data) or Mann–Whitney tests (non-parametric data).

Results

A total of 357 adults were recruited into the study (173 males, 184 females), comprising 285 subjects who had a confirmed diagnosis of diabetes and 72 non-diabetic control subjects who did not have a diagnosis of diabetes. Blood results, however, indicated that 12 of these 72 subjects (16.7%) had FBG and HbA1c values above the range for normoglycaemia, indicating an impaired metabolic condition. Accordingly, as these individuals could not be considered to be definitely non-diabetic and as they also did not have a confirmed diagnosis of diabetes, they were excluded. Therefore, analyses of the impact of diabetes status and control on periodontal variables were based on 345 subjects, comprising the 285 with a confirmed diagnosis of T2DM and 60 non-diabetic comparator subjects. Within the T2DM group, subjects were categorized as having good, moderate or poor glycaemic control according to HbA1c values. These data were not available for 79 subjects. Therefore, comparisons between good, moderate and poor glycaemic control groups were based on 206 subjects. Of these, 112 (54.3%) had good glycaemic control, 53 (25.7%) had moderate control and 41 (19.9%) had poor control. Demographic characteristics of this population, for all diabetic subjects, for all non-diabetic subjects and for the three categories of glycaemic control are shown in Table 1.

The study groups were well matched for age, gender distribution and smoking status, with no significant differences between the groups ($p > 0.05$). In all groups, the proportion of both current and former smokers was low, and > 70% of all subjects had never smoked. There were no significant differences between diabetic and non-diabetic subjects with regard to age or BMI ($p > 0.05$). Both systolic and diastolic BP, however, were significantly higher in non-diabetic subjects than diabetic subjects ($p < 0.01$). Comparisons of the three glycaemic control groups and the non-diabetic subjects together revealed that systolic and diastolic BP were also both significantly higher in the non-diabetic subjects compared with the diabetes subjects with good glycaemic control ($p < 0.01$).

The proportion of subjects affected by chronic periodontitis was high in both groups, with a strong trend to suggest that subjects with T2DM were more likely to also have a diagnosis of chronic periodontitis (33.3%) compared with the non-diabetic subjects (21.7%) ($p = 0.077$).

Periodontal parameters within each of the diabetes groups are presented in Table 2. When comparing T2DM subjects against those who did not have diabetes, it became evident that T2DM subjects had significantly higher mean recession scores and % BoP scores than non-diabetics ($p < 0.01$). Furthermore, within the diabetes glycaemic control categories, % BoP was significantly higher in T2DM patients with good control and those with poor control, compared with non-diabetics ($p < 0.01$). T2DM subjects demonstrated significantly more sites with PD ⩾ 4 and ⩾ 5 mm compared with those who did not have diabetes ($p < 0.01$). Furthermore, good and poor control T2DM patients demonstrated significantly more sites with PD ⩾ 4 mm than non-diabetic patients ($p < 0.01$) and good control T2DM patients demonstrated significantly more sites with PD ⩾ 5 mm than non-diabetic patients ($p < 0.01$). There were no significant differences between any of the groups with regard to the numbers of missing teeth ($p > 0.05$). There was a trend towards more sites demonstrating loss of attach-

Table 1. Characteristics of study population ($n = 345$, all patients except non-diabetics who had impaired metabolic status)

	Diabetes patients (all) ($n = 285$)	Non-diabetic patients (all) ($n = 60$)	Diabetes patients: good control ($n = 112$)	Diabetes patients: moderate control ($n = 53$)	Diabetes patients: poor control ($n = 41$)
Age, mean ± SD (years)	45.7 ± 12.7	45.1 ± 8.6	47.4 ± 13.1	45.5 ± 9.3	44.0 ± 11.5
Gender					
Males, *N* (%)	139 (51.2%)	26 (43.3%)	47 (42.0%)	27 (50.9%)	19 (46.3%)
Females, *N* (%)	146 (48.8%)	34 (56.7%)	65 (58.0%)	26 (49.1%)	22 (53.7%)
Smoking status					
Current smokers, *N* (%)	18 (6.3%)	9 (15.0%)	3 (2.7%)	4 (7.5%)	2 (4.9%)
Former smokers, *N* (%)	35 (12.3%)	8 (13.3%)	10 (8.9%)	7 (13.2%)	3 (7.3%)
Never smokers, *N* (%)	232 (81.4%)	43 (71.7%)	99 (88.4%)	42 (79.2%)	36 (87.8%)
Systolic BP, mean ± SD (mmHg)	129.6 ± 14.9**	136.9 ± 16.4	127.5 ± 12.1**	133.1 ± 17.2	133.3 ± 18.9
Diastolic BP, mean ± SD (mmHg)	81.2 ± 9.2**	85.6 ± 11.9	80.3 ± 7.3**	81.9 ± 11.0	83.1 ± 11.3
BMI, mean ± SD (kg/m^2)	24.7 ± 3.2	24.9 ± 3.7	24.5 ± 3.4	24.9 ± 2.9	24.5 ± 3.0
Periodontal diagnosis					
Health, *N* (%)	109 (38.2%)	25 (41.7%)	41 (36.6%)	26 (49.1%)	14 (34.1%)
Gingivitis, *N* (%)	81 (28.4%)	22 (36.7%)	29 (25.9%)	12 (22.6%)	16 (39.0%)
Chronic periodontitis, *N* (%)	95 (33.3%)	13 (21.7%)	42 (37.5%)	15 (28.3%)	11 (26.8%)

**Significantly lower than in non-diabetic patients ($p < 0.01$).

ment $\geqslant 3$ mm in the diabetic subjects compared with the non-diabetic subjects ($p = 0.07$).

Post hoc analyses focused on the comparisons of parameters of diabetes care between different categories of periodontal status within the T2DM patients, and separately within the non-diabetic patients. Healthy and gingivitis patients were combined into one group ($n = 190$) within the T2DM patients and into one group ($n = 47$) within the non-diabetic group. Within the T2DM patients, there were no significant differences between healthy/gingivitis cases and periodontitis cases with respect to parameters of diabetes care. Within the non-diabetic patients, mean HbA1c scores were significantly higher in the periodontitis cases ($6.1 \pm 0.5\%$; $n = 13$) than in the healthy/gingivitis cases ($5.8 \pm 0.5\%$, $n = 47$) ($p < 0.05$). Multiple linear regression analysis identified that periodontal status (periodontitis *versus* health/gingivitis) was a statistically significant predictor of higher HbA1c values within the non-diabetic patients [B (95% confidence interval) = 0.15 (0.01, 0.31), SE $B = 0.08$, $\beta = 0.26$, $p < 0.05$] but not within the T2DM patients. Within the non-diabetic population, the predictive value of periodontal status remained significant after including BMI in the model.

Discussion

The data from this population-based study confirm those from other cross-sectional studies, which have observed a compromised periodontal status in subjects with T2DM compared with non-diabetic controls (Nelson et al. 1990, Shlossman et al. 1990, Emrich et al. 1991, Taylor et al. 1998, Cutler et al. 2000, Sandberg et al. 2000, Tsai et al. 2002, Engebretson et al. 2004, Lu & Yang 2004, Campus et al. 2005, Jansson et al. 2006, Mattout et al. 2006, Peck et al. 2006). At the subject level, the prevalence of chronic periodontitis in diabetic subjects was higher than in controls (33.3% *versus* 21.7%; $p = 0.077$) yet when the data were presented and analysed as means and standard deviations only GR was significantly greater in the T2DM group compared with the controls (Table 2). T2DM patients, however, had significantly more sites with PD $\geqslant 4$ and $\geqslant 5$ mm compated to the non-diabetic patients. It was apparent that both the diabetes group as a whole and those with good metabolic control had significantly compromised periodontal status when compared with non-diabetic subjects. It is not possible, however, to make reliable statements about the level of diabetes control and severity of periodontal disease because the study was only powered for comparing T2DM subjects with non-diabetic controls and the subgroups of diabetic subjects with moderate and poor control comprised less than half the number of subjects in the good control group. Further, as the periodontal status reflects cumulative disease over many years and HbA1c and FBG allowed only a one-moment-in-time assessment of diabetes control, it is conceivable that a subject with good control may previously, for example, have had only moderate or even poor diabetes control and this would make unequivocal and precise associations between the severity of risk and disease presentation difficult to establish. It was also unfortunate that the subgroup analyses were compromised as a consequence of incomplete data for the HbA1c levels for 79 subjects. These data were obtained from clinical practise records and the absent data were a consequence of the initial practise of clinicians at the outset of our study. The research team, however, as part of a wider contribution to healthcare in Sri Lanka commenced a programme of ongoing education of clinical staff and subsequently, more complete data sets were achieved as recording of HbA1c became routine (Dissanayake et al. 2006, Gunathilake et al. 2009). Despite this limitation, the power calculation was based on PD as the primary out-

Table 2. Periodontal status according to the diabetes category (means ± SD) ($n = 345$, all patients except non-diabetics who had impaired metabolic status)

	Diabetes patients (all) ($n = 285$)	Non-diabetic patients (all) ($n = 60$)	Diabetes patients: good control ($n = 112$)	Diabetes patients: moderate control ($n = 53$)	Diabetes patients: poor control ($n = 41$)
Probing depth (PD) (mm)	2.13 ± 0.78	2.00 ± 0.77	2.21 ± 0.87	1.98 ± 0.60	2.05 ± 0.65
Recession (mm)	0.48 ± 0.82**	0.34 ± 0.74	0.46 ± 0.83	0.45 ± 0.66	0.49 ± 0.84
Loss of attachment (mm)	2.61 ± 1.42	2.34 ± 1.30	2.66 ± 1.49	2.44 ± 1.19	2.53 ± 1.28
Bleeding on probing (%)	16.7 ± 21.5**	8.3 ± 14.4	19.0 ± 24.3**	12.7 ± 17.8	18.8 ± 21.9**
% sites with PD ⩾ 4 mm (%)	10.5 ± 18.7**	5.1 ± 15.7	12.9 ± 21.2**	6.3 ± 13.2	6.7 ± 12.4**
% sites with PD ⩾ 5 mm (%)	4.5 ± 10.8**	2.8 ± 12.1	5.5 ± 12.2**	2.4 ± 6.6	3.3 ± 8.4
% sites with loss of attachment (LOA) ⩾ 3 mm (%)	37.5 ± 30.1	29.7 ± 26.0	41.0 ± 32.8	33.0 ± 25.2	35.2 ± 27.8
% sites with LOA ⩾ 4 mm (%)	21.5 ± 27.5	15.9 ± 24.4	24.5 ± 29.4	17.4 ± 23.3	18.7 ± 25.3
Number of missing teeth (*N*)	4.8 ± 5.3	5.3 ± 5.7	5.4 ± 6.0	4.5 ± 4.3	3.9 ± 5.2

**Significantly higher than in non-diabetic patients ($p < 0.01$).

come of interest and we are confident that clinical comparisons between diabetes and non-diabetes subjects are valid whereas observations resulting from the subgroups analyses are less robust.

One of the unexpected observations from the study was the relatively high prevalence (16.7%) of control subjects with impaired metabolic control, having HbA1c and FBG levels above those that are acceptable for normoglycaemia. The identification and exclusion of these subjects helped to establish a more homogenous control group and demonstrated the importance of the need to profile the controls in any cross-sectional association of periodontitis with risk factors such as diabetes and smoking. It was also reassuring that even with the loss of 12 control subjects, we were able to retain the power (based on PD) for the study by recruiting 72 subjects to the original sample.

When evaluating the periodontal risk in diabetes, it is important to consider the potential confounding effect from the other major risk factor, smoking. In our total population, only 27/345 subjects (7.8%) were current smokers with 18/285 (6.3%) in the diabetes group and 9/60 (15%) in the non-diabetes group. The prevalence of ex smokers was similar between the groups (Table 1) suggesting that for the individual, the diagnosis of diabetes did not have a sufficient impact on health and lifestyle to encourage current smokers to quit the habit.

It is of interest that within the non-diabetic patients, periodontitis (as opposed to health/gingivitis) was a significant predictor of elevated HbA1c values, even after adjusting for BMI (obesity being a key risk factor for insulin resistance, elevated HbA1c and T2DM). Various mechanisms may account for an impact of periodontal disease on HbA1c. It is known that systemic inflammation affects insulin resistance and glucose dynamics (Mealey & Ocampo 2007). Periodontitis can contribute to an elevated systemic chronic inflammatory state, manifested by elevated C-reactive protein, interleukin-6 and fibrinogen, and systemic infections are known to increase insulin resistance and complicate glycaemic control (Yki-Jarvinen et al. 1989). It is possible that periodontitis may elevate the systemic inflammatory state and contribute to increased insulin resistance, potentially leading to elevated HbA1c. This remains conjecture as our findings relate to a small number of patients and will need further investigation in larger studies. A similar effect was not seen in the patients who did have T2DM, presumably because the control of their diabetes outweighed any impact of periodontal status on HbA1c scores.

The prevalence of diabetes in Sri Lankan communities has increased dramatically over the last two decades with reports of 2.5% in 1990 (Illangasekera et al. 1993), 5.2% in 1994 (Fernando et al. 1994), 6.5% in 2002 (Malavige et al. 2002), 8.5% in 2004 (Illangasekera et al. 2004) and 10.3% in 2008 (Katulanda et al. 2008). This trend has been observed in both urban and rural populations, the latter being a consequence of the establishment of factories, better work opportunities and improving socio-economic status in the rural communities (Illangasekera et al. 1993). It is reasonable to assume, therefore, that the prevalence and severity of chronic periodontitis will show a parallel increase with time. The extent to which this has become a problem is difficult to determine, however, as there are few, if any, reliable data from community or epidemiological studies of oral health status in Sri Lanka. The exception, of course, are the natural history studies of periodontitis, which were undertaken on the island in the 1970s and 1980s (Löe et al. 1978a–c, 1986, Anerud et al. 1979).

The 480 male tea workers in the natural history studies were recruited from the Dunsinane and Harrow tea estates in central Sri Lanka. There were distinct subpopulations of subjects categorized according to the progression of the disease: rapidly progressing with attachment loss between 0.5 and 1.0 mm/year at 20–30 years (aggressive in contemporary terms); moderately progressing attachment loss of 0.05–0.3 mm/year (chronic disease); and subjects with no disease progression at all. These respective subpopulations comprised 10%, 80% and 10%, respectively, of the overall population (Löe et al. 1986). The diabetes status of the tea workers was not determined as a risk factor for periodontitis although it is conceivable that a proportion of this Tamil rural population might have had diabetes. There are now some geographically local data that describe the temporal trends for the prevalence of diabetes in the rural community of Hindagala, which is <40 km from the Dunsinane and Harrow estates (Illangasekera et al. 1993). The prevalence of diabetes was around 2.5% in 1990 and this had increased to 8.5% by 2000, which suggests that diabetes is increasingly prevalent in rural central Sri Lanka. The prevalence of periodontal disease in such remote rural communities should perhaps, therefore, be further investigated given the increased

understanding of potential risk factors for the disease that has developed over the last 30 years. Only then will it be possible to identify whether diabetes may be associated with the more aggressive and advanced clinical presentations in this population.

Conclusion

This urban Sri Lankan population of subjects with T2DM demonstrated a compromised periodontal status compared with non-diabetic controls although there is a need to investigate the possible association between diabetes and periodontitis in the rural communities as the prevalence of diabetes continues to increase in Sri Lanka. The awareness of local dentists needs to be raised and appropriate resources afforded to the provision of periodontal care, while considering that the local dental profession does not benefit from the skills of dental hygienists.

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Clinical Relevance

Scientific rationale for the study: Substantial evidence associates periodontitis with diabetes. Sri Lanka has one of the highest prevalence rates of diabetes in the world but there are no reports of an impact of diabetes on oral health.

Principal finding: An urban Sri Lanka population of subjects with T2DM showed a compromised periodontal status compared with non-diabetic controls.

Practical implications: The increasing prevalence of T2DM in Sri Lanka will likely have a significant impact on periodontal health. Awareness among dental practitioners must be raised and dental healthcare provision should target the problem.