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Impact of Chronic Periodontitis on the Quality of Life of Individuals with and without Diabetes

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Abstract

Objective: The aim of the present study was to evaluate the occurrence of chronic periodontitis among individuals with and without diabetes and measure the impact on quality of life in this population.

Methods: A case-control study was conducted at the Endocrinology Clinic of Agamenon Magalhães Hospital and the clinic of the Federal University de Pernambuco (Recife, Brazil). The sample consisted of 116 individuals with type 2 diabetes mellitus and chronic periodontitis, 95 individuals with chronic periodontitis alone (case groups) and 69 healthy individuals without either condition (control group). Data were collected on age, sex, income and schooling and the Oral Health Impact Profile (OHIP-14) was administered in interview format for the evaluation of the impact on quality of life. Clinical examinations were performed and a periogram was filled out for each participant, on which visible plaque, probing depth, bleeding on probing and clinical attachment loss were recorded.

Results: In the group with diabetes, a significant difference in the mean plaque index was found between individuals with and without impact (p=0.023).

Conclusion: In the present study, the impact on quality of life was greater among females, individuals with a higher visible plaque index and those with a fewer number of teeth.

Keywords: Chronic periodontitis; Oral health impact profile; Quality of life; Type 2 diabetes mellitus

Introduction

Periodontitis is an infectious inflammatory disease that affects the periodontium [1] and is caused by an impaired immune response to oral bacteria [2,3]. It is considered to be one of the most common inflammatory diseases throughout the world [4] and causes harm to both the connective tissue and bone [5]. The two main forms are aggressive periodontitis and chronic periodontitis [6], the latter of which occurs due to longstanding exposure to periodontal pathogens [7-9] and is the result of the buildup of dental biofilm, with consequent slow, progressive damage to the supporting structures of the teeth [10]. However, other risk factors, such as smoking, diabetes, stress, medications and poor nutrition, are involved in the onset of gingival inflammation [11].

Diabetes is also considered an important chronic disease throughout the world [12]. It is a metabolic disorder with a multifactor etiology characterized by chronic hyperglycemia [13]. Epidemiological evidence demonstrates a bi-directional relationship between diabetes and periodontitis [14]. The control of periodontitis can contribute to a better blood sugar control, as the oral tissues most commonly affected in diabetes are the periodontal tissues [15].

In the past, quality of life referred to "having a good life" and one's satisfaction with life. In contrast, quality of life is currently defined as a statistical index based on multiple economic, health-related, environment-related and individual-related variables or the living conditions of a group [16]. Initial reports in this field denominated self-rated results "health status". This evaluation can be performed on both patients and the general population. When directed mainly at the evaluation of the patient, it became known as health-related quality of life, which is distinguished from the quality of life of the general population, as the latter partially depends on factors not related to health. Health-related quality of life involves multidimensional evaluations that include the

physical, emotional (or psychological) and social domains and can also include other domains, such as cognitive functioning, sexuality and spirituality [17]. Moreover, differences can be found among different ethnic groups [18].

Studies report that periodontal disease exerts a negative impact on quality of life and such effects are greater among individuals with severe periodontitis. Some studies report that periodontitis not only affects the ability to eat, speak and socialize, but also interpersonal relationships and activities of daily living. Curiously, this condition can even affect the smiling pattern of affected individuals and smile-related quality of life [19].

The psychosocial consequences of oral conditions have received little attention, since such conditions are rarely life threatening. Moreover, the oral cavity has historically been dissociated from the rest of the body. However, recent studies have demonstrated that the emotional and psychosocial consequences of oral problems are as serious at those found with other disorders [20].

The Oral Health Impact Profile (OHIP) is among the assessment tools commonly used as a measure of quality of life [21]. The OHIP-14 is derived from the original 49-item OHIP and is used to evaluate seven dimensions of impact: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap [22]. Altered for dentistry by Locker [23], this scale focuses nearly exclusively on negative impacts stemming from oral problems [24]. Each domain is composed of statements, such as “Have you had to interrupt meals because of problems with your teeth, mouth or dentures?” The response options are scored on a five-point scale: never=0; hardly ever=1; occasionally=2; fairly often=3; and very often=4. The frequency of impact is calculated by the sum of the reported negative impacts (responses of “fairly often” and “very often”). This scale has increased the possibility of measuring and “exploring” the social consequences of oral problems patients consider to be important and is considered the most sophisticated oral health measure [25]. OHIP-14 scores among individuals with gingivitis and periodontitis are higher than those among individuals with a healthy periodontal status. Moreover, total OHIP-14 scores are higher among individuals with periodontitis than those with gingivitis [26].

Type 2 diabetes mellitus (DM2) is considered a pandemic disease. The causal origin of this accelerated development is related to various interacting factors, such as a sedentary lifestyle, excessive body weight, stress and poor eating habits [27]. The prevalence of periodontitis ranges from 20 to 50% in the general population, but is 60% in the population with diabetes [28]. Epidemiological studies and meta-analyses of studies involving diabetic populations have demonstrated that diabetes increases the risk of developing periodontitis approximately threefold compared to individuals without diabetes [29,30].

The evaluation of the impact of diseases on daily living and quality of life is an important component of modernity. Health and patient-centered outcomes are likely more relevant to individuals than traditional clinical measures of a disease [30]. Thus, the aim of the present study was to determine the occurrence of chronic periodontitis among individuals with and without diabetes and measure the impact on quality of life in the population studied.

Methods

Ethical considerations

This study received approval from the human research ethics committees of the Center for Health Science of the Universidade Federal de Pernambuco (certificate number: 1310208) and Agamenon Magalhães Hospital (certificate number: 1368830). All participants received clarifications regarding the objectives and procedures of the study and agreed to participate by signing a statement of informed consent.

Interview

Prior to the clinical examinations, data were collected on age, sex, income and schooling and the OHIP-14 quality of life measure was administered in interview form.

Study design and target population

A case-control study was conducted at the Endocrinology Clinic of Agamenon Magalhães Hospital and the clinic of the Postgraduate Program in Dentistry of the Universidade Federal de Pernambuco.

The study population was composed of 116 individuals with a diagnosis of type 2 diabetes mellitus and chronic periodontitis (DM2+CP), 95 individuals diagnosed with chronic periodontitis (CP) (case groups) and 69 healthy individuals with neither of these two conditions (control group). The participants were recruited from the aforementioned clinics between November 2015 and November 2016. All participants were residents of the state of Pernambuco, Brazil, and were recruited based on the following eligibility criteria:

Inclusion criteria: For all groups, the inclusion criteria were a minimum age of 35 years and having at least eight natural teeth (excluding those with an indication for extraction). In the DM2+CP group, the inclusion criteria were DM2 and a clinical diagnosis of CP. In the CP group, the inclusion criterion was a clinical diagnosis of CP. Individuals without DM2 and without a diagnosis of CP were included in the control group.

Exclusion criteria: Individuals submitted to antibiotic therapy in the previous six months, those making chronic use of an anti-inflammatory agent, those with conditions that compromise systemic immunity, pregnant or nursing women, individuals having been submitted to periodontal treatment in the previous six months, smokers and individuals wearing an orthodontic appliance were excluded from the study.

Clinical aspects

CP was characterized by the presence of inflammation (bleeding on probing), an increase in probing depth and clinical attachment loss, following the recommendations of the American Academy of Periodontology [6]. The diagnosis is based on clinical and radiographic findings, but not all variables are necessarily present. Based on these variables, CP is classified based on severity (mild, moderate or severe) and extent (localized or generalized).

A periogram was filled out for each individual, on which the following were recorded: visible plaque, probing depth, bleeding on probing, clinical attachment loss, mobility and furcation involvement. Six sites were probed for each tooth: mesio-vestibular, mid-vestibular, disto-vestibular, mesio-lingual, mid-lingual and disto-lingual. The examination was performed under artificial light with the aid of an odontoscope and North Carolina millimeter periodontal probe (Trinity®). The examiners wore individual protective equipment. Three examiners and assistants who had undergone training and calibration exercises performed the clinical examinations and recorded the findings on individual charts.

Statistical analysis

The data were expressed as mean (± standard deviation) and frequency distributions. Data on probing depth, clinical attachment level, bleeding on probing and the plaque index were categorized and the likelihood ratio independence test was used to determine associations with genotype, since it was not possible to use Pearson's chi-square test. Associations between the severity/extent of periodontitis and the continuous variables (duration of diabetes, income and age) in individuals with and without diabetes were evaluated using the nonparametric Mann-Whitney test, since the continuous data did not have normal distribution. Associations with discrete variables (sex, smoking habit, schooling and single-nucleotide polymorphisms (alleles and genotypes) were evaluated using the likelihood ratio test.

The multivariate analysis was composed of binary logistic regression. The models were tested using the Omnibus test to find a good fit. The coefficient of determination of the model was calculated based on Nagelkerke's R2. The Hosmer-Lemeshow test was used to compare observed values to expected values. Odds ratios (OR) were also calculated. All independent variables with a p-value of 0.20 in the bivariate analysis were incorporated into the model. A 5% significance level ($p<0.05$) was adopted for the final model. The data were entered into the Microsoft Excel program and the SPSS 20.0 program was used for the data analysis.

Results

Two hundred eighty individuals participated in the present study: 116 (41.5%) in the DM2+ CP group (mean age: 58.2 ± 9.7 years; range: 20 to 80 years), 95 (33.9%) in the CP group (mean age: 51.1 ± 9.6 years; range: 35 to 76 years) and 69 (24.6%) in the control group (mean age: 49.6 ± 10.7; range: 35 to 77 years). The difference in age was statistically significant (p=0.000; nonparametric Kruskal-Wallis test).

The female sex was predominant in all groups: 74.1% of the DM2+CP group, 80.0% in the CP group and 91.3% in the control group. The difference between sexes was statistically significant (p=0.018), but only in the control group **(Table 1)**.

Statistically significant differences among groups were found for marital status, schooling and smoking habits. More individuals in the DM2+CP group were married (64.7%), earned up to two times the Brazilian monthly minimum wage (BMMW) (89.6%) and had a lower level of schooling (incomplete primary school education) (50.9%) compared to the control group. Moreover, 61.2% of the DM2+CP group never smoked versus 85.5% of the control group **(Table 1)**.

Table 1 Characterization of sample (categorical variables) in the different groups.

Variable	Group						Total		p-value
	DM2+ CP		CP		Control				
	n	%	n	%	n	%	n	%	
Sex									
Male	30	25.9	19	20	6	8.7	55	19.6	0.0181
Female	86	74.1	76	80	63	91.3	225	80.4	
Total	116	100	95	100	69	100	280	100	
Marital status									
Married	75	64.7	46	48.4	31	44.9	152	54.3	0.0171
Single	23	19.8	31	32.6	19	27.5	73	26.1	
Divorced	7	6	8	8.4	14	20.3	29	10.4	
Widowed	10	8.6	10	10.5	4	5.8	24	8.6	

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No answer	1	0.9	0	0	1	1.4	2	0.7	
Total	116	100	95	100	69	100	280	100	
Income									
Up to 2 x BMMW	95	89.6	67	75.3	38	66.7	200	79.4	0.0032
2 to 4 x BMMW	7	6.6	19	21.3	15	26.3	41	16.3	
4 to 10 x BMMW	4	3.8	3	3.4	4	7	11	4.4	
Total	106	100	89	100	57	100	252	100	
Smoking habit									
Never smoked	71	61.2	63	66.3	59	85.5	193	68.9	0.0021
Ex-smoker	45	38.8	32	33.7	10	14.5	87	31.1	
Total	116	100	95	100	69	100	280	100	
Schooling									
Illiterate	10	8.8	1	1.1	1	1.4	12	4.3	0.0002
Incomplete primary school	29	25.4	16	16.8	5	7.2	50	18	
Complete primary school	18	15.8	12	12.6	5	7.2	35	12.6	
Incomplete high school	9	7.9	6	6.3	8	11.6	23	8.3	
Complete high school	37	32.5	40	42.1	26	37.7	103	37.1	
Incomplete university	2	1.8	5	5.3	3	4.3	10	3.6	
Complete university	6	5.3	7	7.4	11	15.9	24	8.6	
Does not know	2	1.8	7	7.4	10	14.5	19	6.8	
Did not respond	1	0.9	1	1.1	0	0	2	0.7	
Total	114	100	95	100	69	100	278	100	

BMMW - Brazilian monthly minimum wage; 1- Pearson's chi-square test; 2- Likelihood ratio test; *statistically significant difference (p<0.05)

Mean duration of diabetes was 16.6 ± 24.1 years. Mean income of the diabetic patients was 1.6 ± 1.2 times the BMMW (range: 0 to 10 times the BMMW). Regarding periodontal status in this group, mean probing depth was 2.4 ± 0.7 mm, with 82.8% of the measurements less than 3 mm. Mean clinical attachment loss (CAL) was 3.9 ± 1.7 mm; 42.6% of patients had CAL between 3.0 and 4.9 mm and 22.6% had CAL greater than 5.0 mm. Mean bleeding on probing was 11.6 ± 14.3%, with 78.4% of the patients exhibiting bleeding. The mean plaque index was 26.0 ± 25.4%, with 84.5% of the patients exhibiting plaque. All these variables differed significantly in comparison to the control group **(Table 2)**.

Table 2 Descriptive measures of quantitative variables.

Variable	N		Mean ± SD	Minimum	Maximum	p-value
Age						
DM2+CP	116	A	58.2 ± 9.7	20	80	0
CP	95	AB	53.0 ± 9.6	35	76	
Control	69	B	49.6 ± 10.7	35	77	
Total	280		54.3 ± 10.5	20	80	
Income (x BMMW)						
DM2+CP	106	A	1.6 ± 1.2	0	10	0.004
CP	89	A	1.6 ± 1.3	0	7	

Control	57	B	2.2 ± 1.5	1	7	
Total	252		1.7 ± 1.3	0	10	
Number of teeth						
DM2+CP	116	A	15.8 ± 5.6	8	28	0
CP	95	A	17.7 ± 5.6	8	29	
Control	69	B	20.2 ± 5.8	8	28	
Total	280		17.5 ± 5.9	8	29	
Mean probing depth						
DM2+CP	116	A	2.4 ± 0.7	1.3	5.2	0
CP	95	A	2.3 ± 0.6	1.3	4.4	
Control	69	B	1.9 ± 0.3	1.2	2.8	
Total	280		2.3 ± 0.6	1.2	5.2	
Mean clinical attachment level						
DM2+CP	116	A	3.9 ± 1.7	1.6	10.2	0
CP	95	A	3.5 ± 1.7	1.6	11.9	
Control	69	B	2.1 ± 0.4	1.3	3.8	
Total	280		3.3 ± 1.6	1.3	11.9	
Bleeding index (%)						
DM2+CP	116	A	11.6 ± 14.3	0	100	0
CP	95	A	15.4 ± 14.0	0	50	
Control	69	B	5.1 ± 6.7	0	36.4	
Total	280		11.3 ± 13.3	0	100	
Plaque index (%)						
DM2+CP	116	A	26.0 ± 25.4	0	100	0.003
CP	95	A	25.0 ± 22.9	0	100	
Control	69	B	16.4 ± 19.8	0	100	
Total	280		23.3 ± 23.5	0	100	

1-nonparametric Kruskal-Wallis test, *statistically significant difference (p<0.05)

In the DM2+CP group, the frequency of moderate and severe CP was the same (40.5%) and generalized periodontitis was found in 80.2% of the group. Considering severity and extent, 34.5% had generalized moderate periodontitis and 39.7% had generalized severe periodontitis. No significant differences were found between the DM2+CP and CP groups **(Table 3)**.

Table 3 Distribution of periodontitis severity and extent in DM2+CP and CP groups.

Chronic periodontitis	**Group**				**Total**		**p-value**
	DM2 + CP		**CP**				
	n	**%**	**N**	**%**	**n**	**%**	
Severity							
Mild	22	19	16	16.8	38	18	0.197
Moderate	47	40.5	29	30.5	76	36	
Severe	47	40.5	50	52.6	97	46	
Total	116	100	95	100	211	100	
Extent							
Localized	23	19.8	24	25.3	47	22.3	0.345
Generalized	93	80.2	71	74.7	164	77.7	
Total	116	100	95	100	211	100	

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Classification of CP							
Localized mild	15	12.9	12	12.6	27	12.8	0.153
Generalized mild	7	6	5	5.3	12	5.7	
Localized moderate	7	6	8	8.4	15	7.1	
Generalized moderate	40	34.5	20	21.1	60	28.4	
Localized severe	1	0.9	5	5.3	6	2.8	
Generalized severe	46	39.7	45	47.4	91	43.1	
Total	116	100	95	100	211	100	

1- likelihood ratio test; *statistically significant difference (p<0.05)

A significant association (p=0.037) was found between the classification of periodontitis and sex. Generalized severe periodontitis was more frequent among males in the DM2+CP group (56.7%). No significant associations were found between the classification of chronic periodontitis and income, smoking habit or duration of diabetes (p>0.05) **(Table 4)**.

Table 4 Distribution of classification of chronic periodontitis according to sex, smoking habit, income and duration of diabetes in DM2+CP group.

Variable	Classification of Chronic Periodontitis												Total		p-value[1]
	Localized mild		Generalized mild		Localized moderate		Generalized moderate		Localized severe		Generalized severe				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Sex															
Male	2	6.7	0	0	2	6.7	8	26.7	1	3.3	17	56.7	30	100	0.037
Female	13	15.1	7	8.1	5	5.8	32	37.2	0	0	29	33.7	86	100	
Total	15	12.9	7	6	7	6	40	34.5	1	0.9	46	39.7	116	100	
Income															
Up to 2 x BMMW	14	14.7	7	7.4	7	7.4	36	37.9	0	0	31	32.6	95	100	0.201
2 to 4 x BMMW	1	14.3	0	0	0	0	1	14.3	1	14.3	4	57.1	7	100	
4 to 10 x BMMW	0	0	0	0	0	0	1	25	0	0	3	75	4	100	
Total	15	14.2	7	6.6	7	6.6	38	35.8	1	0.9	38	35.8	106	100	
Smoking habit															
Never smoked	9	12.7	5	7	7	9.9	25	35.2	0	0	25	35.2	71	100	0.075
Ex-smoker	6	13.3	2	4.4	0	0	15	33.3	1	2.2	21	46.7	45	100	
Total	15	12.9	7	6	7	6	40	34.5	1	0.9	46	39.7	116	100	
Duration of diabetes															
≤ 5 years	6	14.3	1	2.4	3	7.1	13	31	1	2.4	18	42.9	42	100	0.608
> 5 and ≤ 10 years	2	7.4	3	11.1	1	3.7	13	48.1	0	0	8	29.6	27	100	
>10 years	7	14.9	3	6.4	3	6.4	14	29.8	0	0	20	42.6	47	100	
Total	15	12.9	7	6	7	6	40	34.5	1	0.9	46	39.7	116	100	
Insulin use															
Yes	6	15.4	1	2.6	1	2.6	11	28.2	0	0	20	51.3	39	100	0.268
No	9	11.7	6	7.8	6	7.8	29	37.7	1	1.3	26	33.8	77	100	

Total	15	12.9	7	6	7	6	40	34.5	1	0.9	46	39.7	116	100	
BMMW – Brazilian monthly minimum wage; 1- likelihood ratio test; * statistically significant difference (p<0.05)															

A significant association (p=0.007) was found between the classification of periodontitis and sex in the CP group, with a greater frequency of generalized severe periodontitis among males (78.9%). No significant associations were found between the classification of chronic periodontitis and income or smoking habit (p>0.05) **(Table 5)**.

Table 5 Distribution of classification of chronic periodontitis according to sex, smoking habit and income in CP group.

Variable	Classification of Chronic Periodontitis												Total		p-value[1]
	Localized mild		Generalized mild		Localized moderate		Generalized moderate		Localized severe		Generalized severe				
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	
Sex															
Male	0	0	0	0	0	0	3	15.8	1	5.3	15	78.9	19	100	0.01
Female	12	15.8	5	6.6	8	10.5	17	22.4	4	5.3	30	39.5	76	100	
Total	12	12.6	5	5.3	8	8.4	20	21.1	5	5.3	45	47.4	95	100	
Income															
Up to 2 x BMMW	10	14.9	5	7.5	6	9	14	20.9	3	4.5	29	43.3	67	100	0.34
2 to 4 x BMMW	0	0	0	0	2	10.5	4	21.1	2	10.5	11	57.9	19	100	
4 to 10 x BMMW	0	0	0	0	0	0	1	33.3	0	0	2	66.7	3	100	
Total	10	11.2	5	5.6	8	9	19	21.3	5	5.6	42	47.2	89	100	
Smoking habit															
Never smoked	8	12.7	3	4.8	6	9.5	15	23.8	1	1.6	30	47.6	63	100	0.35
Ex-smoker	4	12.5	2	6.3	2	6.3	5	15.6	4	12.5	15	46.9	32	100	
Total	12	12.6	5	5.3	8	8.4	20	21.1	5	5.3	45	47.4	95	100	
BMMW – Brazilian monthly minimum wage; 1- likelihood ratio test, * statistically significant difference (p<0.05)															

Table 6 displays the impact on quality of life in the DM2+CP group. The only significant association was with sex (p=0.033), as 52.3% of the females reported impact versus 30.0% of the males. No significant associations were found for the other variables.

Table 6 Distribution of variables according to impact on quality of life (OHIP-14) in DM2+CP group.

Variable	OHIP				Total		p-value[1]
	Without impact		With impact				
	n	%	n	%	n	%	
Sex							
Male	21	70	9	30	30	100	0.033*
Female	41	47.7	45	52.3	86	100	
Total	62	53.4	54	46.6	116	100	
Marital status							
Married	39	52	36	48	75	100	0.382
Single	10	43.5	13	56.5	23	100	
Divorced	5	71.4	2	28.6	7	100	
Widowed	7	70	3	30	10	100	
Total	61	53	54	47	115	100	
Income							

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Up to 2 x BMMW	50	52.6	45	47.4	95	100	0.654
2 to 4 x BMMW	4	57.1	3	42.9	7	100	
4 to 10 x BMMW	3	75	1	25	4	100	
Total	57	53.8	49	46.2	106	100	
Smoking habit							
Never smoked	42	59.2	29	40.8	71	100	0.121
Ex-smoker	20	44.4	25	55.6	45	100	
Total	62	53.4	54	46.6	116	100	
BMMW – Brazilian monthly minimum wage; 1- likelihood ratio test; *statistically significant difference (p<0.05)							

None of the variables analyzed was associated with an impact on quality of life in the CP group **(Table 7)**.

None of the variables analyzed was associated with an impact on quality of life in the control group **(Table 8)**.

The mean plaque index in the DM2+CP group differed significantly (p=0.023) between those with no impact on quality of life (32.00 ± 29.60) and those with impact on quality of life (19.21 ± 17.40). No significant differences in the plaque index were found in the CP and control groups. Significant associations were found between the number of teeth and impact on quality of life in the DM2+CP (p=0.005) and CP (p=0.010) groups, with a higher mean number of teeth among those with no impact on quality of life **(Table 9)**.

Table 7 Distribution of variables according to impact on quality of life (OHIP-14) in CP group.

Variable	OHIP				Total		p-value
	Without impact		With impact				
	n	%	n	%	n	%	
Sex							
Male	9	47.4	10	52.6	19	100	1
Female	36	47.4	40	52.6	76	100	
Total	45	47.4	50	52.6	95	100	
Marital status							
Married	23	50	23	50	46	100	0.909
Single	13	41.9	18	58.1	31	100	
Divorced	4	50	4	50	8	100	
Widowed	5	50	5	50	10	100	
Total	45	47.4	50	52.6	95	100	

Income							
Up to 2 x BMMW	28	41.8	39	58.2	67	100	0.201
2 to 4 x BMMW	12	63.2	7	36.8	19	100	
4 to 10 x BMMW	2	66.7	1	33.3	3	100	
Total	42	47.2	47	52.8	89	100	
Smoking habit							
Never smoked	32	50.8	31	49.2	63	100	0.347
Ex-smoker	13	40.6	19	59.4	32	100	
Total	45	47.4	50	52.6	95	100	
BMMW – Brazilian monthly minimum wage; 1- likelihood ratio test; *statistically significant difference (p<0.05).							

Table 8 Distribution of variables according to impact on quality of life (OHIP-14) in control group.

Variable	OHIP				Total		p-value[1]
	Without imapct		With impact				
	n	%	n	%	n	%	
Sex							
Male	4	66.7	2	33.3	6	100	0.369
Female	30	47.6	33	52.4	63	100	
Total	34	49.3	35	50.7	69	100	
Marital status							
Married	17	54.8	14	45.2	31	100	0.803
Single	8	42.1	11	57.9	19	100	
Divorced	6	42.9	8	57.1	14	100	
Widowed	2	50	2	50	4	100	
Total	33	48.5	35	51.5	68	100	
Income							
Up to 2 x BMMW	15	39.5	23	60.5	38	100	0.378

2 to 4 x BMMW	7	46.7	8	53.3	15	100	
4 to 10 x BMMW	3	75	1	25	4	100	
Total	25	43.9	32	56.1	57	100	
Smoking habit							
Never smoked	31	52.5	28	47.5	59	100	0.182
Ex-smoker	3	30	7	70	10	100	
Total	34	49.3	35	50.7	69	100	
BMMW – Brazilian monthly minimum wage; 1- likelihood ratio test; *statistically significant difference (p<0.05)							

Table 9 Descriptive measures of variables according to impact on quality of life (OHIP-14) in each group.

Variable	DM2+CP			CP			Control		
	N	Mean ± SD	p-value1	N	Mean ± SD	p-value[1]	N	Mean ± SD	p-value[1]
Mean probing depth									
Without Impact	62	2.43 ± 0.66	0.778	45	2.29 ± 0.52	0.958	34	1.89 ± 0.34	0.316
With Impact	54	2.46 ± 0.68		50	2.30 ± 0.61		35	1.84 ± 0.27	
Mean clinical attachment loss									
Without Impact	62	3.74 ± 1.61	0.389	45	3.18 ± 0.96	0.495	34	2.16 ± 0.45	0.54
With Impact	54	4.06 ± 1.74		50	3.83 ± 2.12		35	2.12 ± 0.44	
Bleeding index									
Without Impact	62	13.25 ± 16.47	0.31	45	14.81 ± 12.54	0.985	34	4.70 ± 5.81	0.955
With Impact	54	9.71 ± 11.26		50	15.94 ± 15.39		35	5.48 ± 7.58	
Plaque index (%)									
Without Impact	62	32.00 ± 29.60	0.023	45	22.50 ± 20.24	0.416	34	15.38 ± 19.79	0.642
With Impact	54	19.21 ± 17.40		50	27.24 ± 25.02		35	17.32 ± 20.08	
Number of teeth									
Without Impact	62	17.19 ± 5.88	0.005	45	19.20 ± 5.60	0.01	34	21.03 ± 5.42	0.33
With Impact	54	14.13 ± 4.84		50	16.38 ± 5.38		35	19.37 ± 6.13	
1- likelihood ratio test, *statistically significant difference (p<0.05)									

Discussion

Type 2 diabetes mellitus (DM2) is considered a pandemic. The causal origin of its accelerated development is related to several interacting factors, such as a sedentary lifestyle, excessive body weight, stress and poor eating habits [27]. The prevalence of periodontitis ranges from 20 to 50% in the general population, but is 60% in the population with diabetes [28]. Epidemiological studies and meta-analyses of studies involving diabetic populations demonstrate that diabetes increases the risk of developing periodontitis approximately threefold in comparison to individuals without diabetes [29,30].

Periodontal diseases consist of inflammatory processes of infectious origin that affect the gingival tissues (gingivitis) and/or the supporting tissues of the teeth (periodontitis) [1]. They occur as a consequence of the inflammatory and immunological reactions in the periodontal tissues induced by the microorganisms of the dental biofilm (bacterial plaque), damaging the connective tissue and the alveolar bone [2,3]. The bacterial biofilm plays an important role in the pathogenic process. Strategies to avoid accumulation through good oral hygiene and scaling and root planing should be employed.

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While bacteria are essential for triggering the disease, the evolution and extent of periodontal damage are also related to host susceptibility [2]. Chronic periodontitis is a silent disease with a slow evolution that causes tooth loss in the final stage [31]. Moreover, its occurrence has recently been demonstrated to have a substantial social-behavioral component. This condition is therefore considered not only a threat to the dentition, but also affects oral health-related quality of life [32], which is defined as a multidimensional concept that reflects comfort when eating, sleeping and engaging in social relationships, affecting one's self-esteem and contentment with regard to oral health [33].

Although there is no consensus on the concept of quality of life, three fundamental aspects referring to this construct have been determined by a group of experts from different cultures: 1) subjectivity, 2) multidimensionality and 3) positive (i.e., mobility) and negative (i.e., pain) dimensions. The consideration of these elements has led to a definition of quality of life as "individuals' perceptions of their position in life in the context of the culture and value system in which they live and in relation to their goals, expectations and standards and concerns" [34].

A large number of indices have been developed in an attempt to evaluate how oral problems affect quality of life. One of the most described and widely used of which is the Oral Health Impact Profile (OHIP), which was developed to obtain information on the nature and extent of functional, social and psychological impacts in dental studies, procedures and clinical evaluations. The subscales of the OHIP are functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability and handicap [23,35-39]. The OHIP is one of the most widely used questionnaires and its reliability has been confirmed. It was created and developed in Australia [40] and has been translated and adapted to several languages and cultures [41]. The 49-item questionnaire was subsequently reduced to 14 items that have proven to be effective and useful for assessing the impact of oral problems on quality of life [36].

The literature reports that individuals with periodontal problems experience negative impacts on quality of life [42-44]. However, there are no previous studies regarding this perception among individuals with diabetes.

Each individual has the capacity for perceptions regarding his/her health and its effect on his/her daily life [35]. In diabetic individuals, the perception of oral health may be altered, especially in the occurrence of chronic periodontitis, which is one of the complications of diabetes and can also be associated with emotional disorders in affected individuals.

In the present study, the female sex predominated, which may be due to the fact that more women seek healthcare services and the impact on quality of life in individuals of this gender is more important.

It is necessary to develop specific strategies to minimize the negative effects of chronic periodontitis. A different philosophical approach, with the participation of the patient in the therapeutic process, could be the best way to increase awareness regarding the responsibility for seeking care as well as changing the perspective of patients with regard to health in all its domains (physical, social, familial, emotional and functional) [44]. In the present study, the visible plaque index exerted an impact on quality of life and the number of teeth in individuals with impact on quality of life was lower in the group with diabetes.

Conclusion

In the present study, individuals with chronic periodontitis reported a negative impact on quality of life. Moreover, the impact on quality of life was greater among females, individuals with a higher visible plaque index and those with a fewer number of teeth.

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